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ABSTRACT

This technical specialty course is one of thirty-five courses designed for use by two-year postsecondary institutions in five nuclear technician curriculum areas: (1) radiation protection technician, (2) nuclear instrumentation and control technician, (3) nuclear materials processing technician, (4) nuclear quality-assurance/quality-control technician, and (5) nuclear reactor (plant) operator trainee. This course, Introduction to Quality Assurance/Quality Control, contains nine modules: Basic Requirements for Quality Assurance/Quality Control, Definitions and Descriptions of Quality-Assurance/Quality-Control Criteria, Governmental Regulation of Quality Assurance/Quality Control, Technical Regulation of Quality Assurance/Quality Control, Implementation of Quality-Assurance/Quality-Control Programs and Procedures, Application of Quality Assurance/Quality Control to Industry, Techniques and Variations in Quality Assurance/Quality Control, Quality Assurance/Quality Control Records and Documents, and Special Studies in Quality Assurance/Control. Each module follows a typical format including the following sections: introduction, module prerequisites, objectives, subject matter, exercises, materials, procedures, data tables, reference materials, and tests. (A master index and suggested program planning guide are also available--see CE 026 856 and CE 026 639-643.) (IRA)

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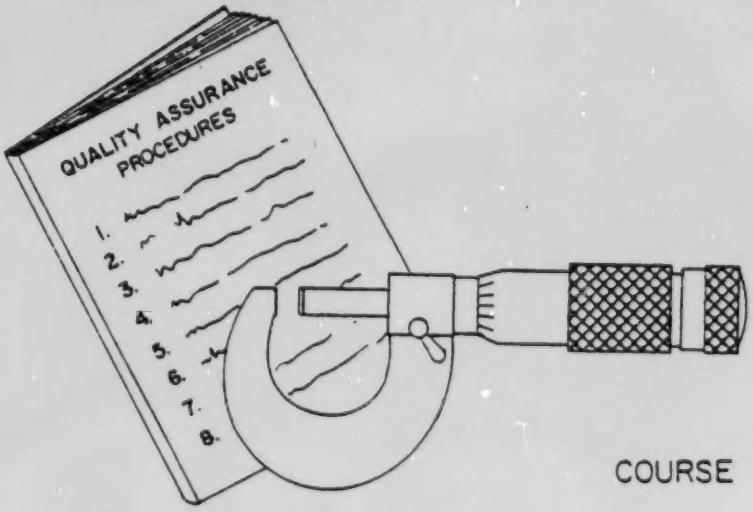
NUCLEAR TECHNOLOGY

Series

MODULE 14-1 BASIC REQUIREMENTS FOR QUALITY ASSURANCE/QUALITY CONTROL.

INTRODUCTION TO QUALITY ASSURANCE / QUALITY CONTROL



COURSE 14

CE026 655

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COURSE MODULES

COURSE 14 INTRODUCTION TO QUALITY ASSURANCE/QUALITY CONTROL

MODULE 14-1 Basic Requirements for Quality Assurance/ Quality Control

MODULE 14-2 Definitions and Descriptions of Quality-Assurance/Quality-Control Criteria

MODULE 14-3 Governmental Regulation of Quality Assurance/ Quality Control (AEC, NRC)

MODULE 14-4 Technical Regulation of Quality Assurance/ Quality Control (ASME, ANSI)

MODULE 14-5 Implementation of Quality-Assurance/Quality-Control Programs and Procedures

MODULE 14-6 Application of Quality Assurance/Quality Control to Industry

MODULE 14-7 Techniques and Variations in Quality Assurance/Quality Control

MODULE 14-8 Quality-Assurance/Quality-Control Records and Documents

MODULE 14-9 Special Studies in Quality Assurance/ Control

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INTRODUCTION

Expanding use of nuclear power in generating electricity, as well as production of nuclear components in industry, makes it necessary for the Nuclear Regulatory Commission (NRC) to see that its regulations include quality-assurance criteria as found in Appendix "B," Title 10, CFR50 (Code of Federal Regulations, Part 50). The terms, quality assurance (QA) and quality-assurance criteria (QAC), for nuclear power plants, were introduced to the industry for the first time in April, 1969.

Quality-assurance criteria mandate that every applicant for a nuclear facility construction permit, or an operating permit, include in its application a description of the quality-assurance program to be applied to the following areas:

Design.
Fabrication.
Construction.
Testing.
Operation.

This quality-assurance program must include information pertaining to managerial and administrative controls for safe operation of the facility. This requirement protects the health and safety of the public.

Quality control (QC) is that part of quality assurance covering actions taken to check, test or verify that skills and techniques of workmanship included in the making of products meet pre-established physical characteristics. Quality assurance complements quality control by taking actions to record and document that quality-controlled products will perform satisfactorily in service.

MODULE PREREQUISITES

None.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Discuss intent of the Atomic Energy Act of 1954.
2. Describe basic responsibility of the original Atomic Energy Commission (AEC).
3. Identify basic measures stipulated by Federal regulations to avoid misuse of nuclear fuels by special interest groups.
4. State how the Nuclear Regulatory Commission (NRC) was established.
5. Describe how a site location is selected for a nuclear facility.
6. Describe main purpose of a Preliminary Safety Analysis Report (PSAR).
7. Describe main purpose of an Environmental Report (ER).
8. Discuss construction permit for nuclear facility.
9. State main purpose of operating license and Final Safety Report (FSR).
10. Define "quality control" and "quality assurance."
11. Describe basic differences between QA and QC.
12. Discuss why a combination of QA/QC is essential to the nuclear industry.

13. Name the main participants in licensing a nuclear facility.
14. State why each participant must have a QA program.
15. State how the American Society of Mechanical Engineers (ASME) affects QA/QC.
16. State how American National Standards Institute (ANSI) standards are used by the nuclear industry.
17. Name and describe functions of two other societies having an impact on QA/QC.
18. List effects of QA/QC on the nuclear industry's self-regulating ability.

FEDERAL REGULATORY PROCESS

After World War II, the United States Congress enacted legislation known as the Atomic Energy Act of 1954, providing for peaceful use of nuclear power by private industry.

This Act permitted the Federal government to share with private industry, on a limited basis, some of the technology and development gained by U.S. military during the war.

Also, the Act stipulated that a special commission be established to administer and regulate the nuclear industry to protect public health and safety from the possible dangers and abuses of nuclear energy; therefore, the Atomic Energy Commission (AEC) was established and charged with this responsibility.

The AEC, which had five commissioners appointed by the President and confirmed by Congress, and had many branches (including Reactor Development, Nuclear Fuel Processing, Licensing of Facilities and Inspections), was dissolved in June, 1974, by the Energy Reorganization Act of 1974.

The 1974 Act replaced AEC with two bodies: the Energy Research and Development Administration (ERDA) and the Nuclear Regulatory Commission (NRC). (In 1977, ERDA was absorbed into a new Department of Energy.)

The primary purpose of Federal regulation of the nuclear industry is to protect the health and guard the safety of the public from possible danger or sabotage of nuclear facilities. But Federal regulations also attenpt to control peaceful development of nuclear energy while avoiding

potential use of nuclear fuels in weapons by special interest groups. Federal regulations provide for inspections of any nuclear installation for all activities of design, fabrication, and construction of structures, systems and components.

The AEC, during its tenure from 1954 through 1974, was responsible for both the development of and the regulation of nuclear energy. Construction permits and operating licenses were issued and on-site inspections of facilities were conducted by Commission personnel.

After 1974, NRC had sole responsibility for licensing and monitoring industry activities. It evaluates proposed sites, reviews preliminary safety analysis reports, evaluates quality-assurance programs, issues construction permits and grants plant operating licenses.

The NRC, in addition to its regulatory functions, develops and issues regulatory guides to assist industry in meeting the requirements of Federal regulations. Further, NRC publishes three instruction books (green, gray and brown), called the "Rainbow Series," intended to standardize formats of safety analysis reports, quality-assurance programs and applications for construction permits and licenses.

Licensing a nuclear facility is a time-consuming, detailed and legally complicated procedure involving local, state and federal groups. Usually, local and state authorities coordinate their efforts with the Federal regulators; thus, meeting Federal regulation requirements suffices for all.

The four major items of licensing a nuclear facility include:

Site location determination.

Preliminary Safety Analysis Report (PSAR) and Environ-

mental Report (ER).
Construction permits and licensing.
Operation licensing and Final Safety Report (FSR).

SITE LOCATION DETERMINATION

The site selected for a nuclear facility must be evaluated by NRC to determine:

Population density in area.
Geographical conditions of location.
Available water resource.
Environmental impact resulting from facility.
Meteorological conditions.
Other prevailing circumstances.

All of the above conditions must prove to be favorable and in the best interest of the public's safety and health before a location is deemed acceptable.

PRELIMINARY SAFETY ANALYSIS REPORT (PSAR) AND ENVIRONMENTAL REPORT (ER)

After selecting a site location for a nuclear facility, the facility owner must prepare (or contract with a consulting firm to prepare for it) a Preliminary Safety Analysis Report (PSAR) describing in complete and full detail all engineering and technical evaluations and calculations of plant design and operating features.

This PSAR must be submitted to the Nuclear Regulatory Commission for review and must show that the intended facility is safe, has minimum impact on the environment and has the necessary quality-assurance program and organization

to monitor and surveil (watch over) commitments made in the PSAR.

In addition tc the PSAR, the owner or consultant must prepare an Environmental Report (ER) based on a long-term study and evaluation of data relative to impact on the environment by the nuclear facility. The ER must contain information on the effect on humans, livestock, vegetation, fish, birds and other living occupants of the environment in the vicinity of the nuclear facility.

The NRC and the EPA must find all results of the ER favorable and in the best interest of the health and safety of the public before granting permission to proceed with construction of the facility.

CONSTRUCTION PERMITS AND LICENSING

Upon approval of the PSAR and ER by the NRC, the owner of the nuclear facility must obtain a Federal construction permit before proceeding with any activity at the site. This construction permit may be partial, stipulating that only certain portions of the facility may be constructed, or a full permit allowing construction as delineated in the PSAR.

In either case, the facility owner must establish an engineering, construction and quality-assurance organization corresponding to provisions of the PSAR. Each of these organizations or groups must prepare the necessary procedures to ensure that each phase of engineering, equipment procurement and manufacture, construction and quality-assurance records, and quality-control inspections is in full compliance with the regulations, PSAR and other codes and standards.

Upon completion of construction of a nuclear facility, and if all inspections and documentations are consistent with the PSAR and construction permit provisions, the owner must request from the NRC an operating license to commission the facility.

OPERATING LICENSE AND FINAL SAFETY REPORT (FSR)

The operating license of a nuclear facility issued by NRC must stipulate:

Type of fuel to be used in facility.
Fuel enrichment permitted.
Operating thermal conditions of reactor.
Reactor core fuel burn-up rate.

Operating licenses are issued only upon owner's completion of a Final Safety Report (FSR), updating or complementing the PSAR. The FSR must include all amendments, changes, revisions and modifications to the design, installation and construction of the facility described in the PSAR. Included in the FSR must be provisions indicating that all quality-assurance and quality-control records and documentation have been audited and found to be complete and acceptable. The FSR must also describe in detail how the owner-operator of the facility intends to continue its QA/QC efforts during operation of the facility. A QA/QC organization must be identified, and in-service inspection and records must be defined.

GENERAL OVERVIEW OF QUALITY-ASSURANCE/ QUALITY-CONTROL FUNCTIONS

Quality control means those actions taken by quality-control personnel to inspect, check and verify that work activities are conducted in accordance with approved procedures to achieve prescribed quality requirements of the work. Quality control ensures that physical characteristics of an item or a work activity are within the standard of quality required for the item or activity.

Quality assurance means those actions taken by quality-assurance personnel to provide adequate confidence that an item or work activity has the necessary degree of excellence and physical characteristics to perform satisfactorily in service. Quality assurance, which includes quality control, provides documents that predetermined quality was controlled in the process of designing and producing an item or work activity.

QA/QC is not intended to set the standard of quality for an item or work activity. This standard of quality must be established by the owner, designer or engineer or the regulatory bodies, codes and standards. Quality control monitors the progress of activities to verify that skills and techniques are being included in the design and making of products and work activities. Quality assurance documents and records the actions of verifying that the quality has been incorporated as set forth in the controlling requirements of the product.

OTHER PARTICIPANTS IN THE LICENSING PROCESS

Although the owner of a nuclear facility is primarily responsible for the licensing of such facilities, many other groups and entities are involved in the process. The complexities of conceiving the design, construction and technical specifications of a nuclear facility make it necessary that some or all of the following entities share or be involved in some way in the licensing process:

Consultants.
Manufacturers.
Constructors.
Suppliers/service contractors.

If the owner chooses to obtain technical assistance from a consultant to prepare the PSAR and ER, such consultant must be officially designated by the owner. The consultant then must submit credentials, including expertise, experience and quality-assurance program, to NRC for evaluation through the owner. The owner is responsible to NRC for all activities of the project. Every participating organization in the project must abide by the owner's commitments to NRC and must be fully competent to perform its functions.

Manufacturers of major nuclear components, such as reactors, steam generators, primary coolant pumps and nuclear fuel cores, must also prove their competency, expertise and quality assurance for review through the owner.

Intended constructor or constructors of the facility should be identified in the PSAR. Such organizations must have organizational, managerial and quality-assurance capabilities acceptable to the NRC before licensing may be achieved. If constructors are not known or have not been

selected, the facility owner must make the necessary commitments in the PSAR to assure NRC that construction and constructors will have the necessary expertise, experience and quality-assurance programs to meet licensing requirements.

Suppliers, service contractors and other organizations that may be involved in construction of the facility (or portions of the facility that fall under control and regulation of NRC) must meet the same requirements as the owner, designer, major equipment manufacturers and constructor or constructors.

THE ROLE AND FUNCTION OF TECHNICAL AND PROFESSIONAL ORGANIZATIONS AND THEIR IMPACT ON QA/QC

The magnitude and complexity of a nuclear facility make it difficult for any one regulatory body or technical group to cope with all the technological and developmental requirements; therefore, through regulatory processes and administrative procedures, the expertise, experience and technical capabilities of many organizations are able to interact by exchanging technical information and consolidating safety goals, thereby assuring the public that a nuclear facility can be designed, constructed and operated in a manner that protects the health and guards the safety of every individual; for example:

American Society of Mechanical Engineers (ASME).
American National Standards Institute (ANSI).
American Society for Testing Materials (ASTM).
Institute of Electrical and Electronic Engineers (IEEE).

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

The ASME, by means of its collective effort to gather technical and scientific data and information, publishes the Boiler and Pressure Vessel Code (Code), which includes two major parts known as the Nuclear Section III. This section of the Code includes design parameters and engineering data most essential to the fabrication and installation of nuclear components and piping. In this section are also some mandatory requirements for QA/QC that must be met in every phase of material and equipment procurement, processing, receiving, fabricating, testing and inspection. The NRC, by referencing and endorsing the ASME Code, makes it an essential part of the licensing requirements.

THE AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

The ASTM is a voluntary standard technical society dedicated to providing scientific and technical specifications on a wide range of materials. The ASTM collates its scientific efforts to complement and supplement other known and available data to the industry. The ASTM, through its specifications, makes it possible for industry and manufacturing to share a common objective of standardizing the physical and chemical properties of a vast range of products.

THE INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

The IEEE is another professional society whose efforts are dedicated to providing industry and manufacturing with

standards to guide the electrical and electronic industries. The IEEE plays an important role in the nuclear industry in standardizing its approach to electrical and electronic systems design and manufacturing.

OTHER SOCIETIES AND ORGANIZATIONS

There are numerous other groups and organizations dedicated to quality and consistency in industry and science, including the following:

The American Concrete Institute (ACI).
The American Welding Society (AWS).
The Manufacturers Standardization Society of the Valve and Fitting Industry (MSS).
The American Nuclear Society (ANS).
The American Society of Quality Control (ASQC).

THE INDUSTRY AND ITS SELF-REGULATING ABILITY

The nuclear industry has become one of the largest industries in the United States, based on dollar volume of business and number of technical, professional and production employees supported. The concern of local, state and federal regulators for the health and safety of the public made it necessary to impose numerous restrictions, regulations, procedures and guidelines on this industry. Such actions by regulators have made it necessary for the industry to make expedient and drastic adjustments in its mode of operation.

The single most important adjustment was establishment of quality-assurance programs and quality-assurance organizations.

Quality control had existed in manufacturing for decades; however, quality assurance, which requires documentation of quality-control actions, created a new dimension in the industry.

Quality assurance demands that its functions be independent from production, cost control and schedule planning; therefore, major restructuring of most organizations was necessary to provide such independence.

In the past decade, the nuclear industry has witnessed some important and dramatic changes in organizational and operating structures of each and every entity involved in or associated with the nuclear industry. For the most part, these changes resulted from implementation of Appendix B to 10CFR50, "Quality Assurance Criteria," or, as it is more commonly known, the "Eighteen Criteria."

COMPETITION IN THE MARKET PLACE

Organizations who established their quality-assurance programs at early dates after they became mandatory in 1969 were able to secure business commitments in advance of those who established their programs later. The results were that everyone had to incorporate quality assurance to compete fairly in the market. Quality assurance became a salable feature of industry when its products and services became acceptable to NRC.

REDUCTION IN COST

The procedural controls imposed on production of materials and equipment, as a result of formalizing quality assurance, have been credited with some cost reductions in the industry. As an example, discovery of errors on a timely basis prevented higher costs of later repairs or total rejection of the product.

MEETING SCHEDULES

Although quality assurance is independent of any involvement in cost and scheduling, it has made meeting industry's commitment schedules easier by avoiding or preventing schedule delays related to product quality or documentation.

OBTAINING OPERATING LICENSES

Owners of nuclear facilities working with well prepared organizations implementing quality-control and quality-assurance programs have found it more expedient and less troublesome to obtain licensing from the regulatory bodies. Quality control and quality assurance have been credited with helping the regulatory bodies to assess and prove, through review of records and documents, that public health and safety have been safeguarded.

EXERCISES

None.

MATERIALS

None.

PROCEDURES

1. From the library, check out a copy of the "Atomic Energy Act of 1954;" make a comprehensive review of the Act and write a statement on each of the following:
   - Intent of the Atomic Energy Act of 1954, including its provisions to guard public health and safety.
   - How AEC was established, including assigned responsibilities.
   - Measures specified in the Act to prevent misuse of nuclear fuels by special interest groups.
2. Check out a copy of the "Energy Reorganization Act of 1974;" review its contents and write a statement on the following:
   - How NRC was established.

Differences, if any, between AEC and NRC.

From the text of this module, summarize NRC licensing procedures; describe purposes of PSAR and ER.

3. From library or instructor, obtain copy of "Quality Assurance Criteria for Nuclear Power Plants," Title 10 - Atomic Energy, Federal Register, Volume 35, No. 125, June, 1970; study introduction to Criteria; write, in your own words, the following:

   A definition of quality assurance.

   A definition of quality control.

   A summary of differences between quality assurance and quality control.

4. From library or instructor, obtain a copy of ASME Boiler and Pressure Vessel Code, Section III - Division 1, Subsection NA. Review Article Na-4000; summarize the following:

   General requirements of quality assurance.

   How these requirements differ, if they do, from those listed in Quality Assurance Criteria for Nuclear Power Plants.

5. From library or instructor, obtain copy of ANSI Standard N45.2; review and summarize role of ANSI in nuclear industry.

DATA TABLE

20

None.

American Society of Mechanical Engineers. "Quality Assurance," ASME Boiler and Pressure Vessel Code, Section III, Division 1. New York: ASME, 1974.

U.S. Atomic Energy Commission. "Quality Assurance Criteria for Nuclear Power Plants." Code of Federal Regulations, Title 10 - Atomic Energy. Federal Register 35, No. 125, June 1970.

_____. "Guidance on Quality Assurance Requirements During Construction Phase of Nuclear Power Plants." Rainbow Series, Green Book. WASH-1309 UC-80, 10 May 1974.

_____. "Guidance on Quality Assurance Requirements During Design and Procurement Phase of Nuclear Power Plants," Revision 1. Rainbow Series, Gray Book. WASH-1283 UC-80, 24 May 1974.

_____. "Guidance on Quality Assurance Requirements During Operations Phase of Nuclear Power Plants." Rainbow Series, Orange Book. 26 October 1973.

USAEC documents available by writing Superintendent of Documents. U.S. Government Printing Office, Washington, DC 20402.

U.S. Congress, Senate. Energy Reorganization Act of 1974. Report No. 93-980. 93rd Cong., 2nd sess., June 1974.

Available by asking for Congressional Record from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Read each question carefully. Be sure to provide the specific information each question requires. Make your answers brief. Use the backs of the test if you need more space.

1. Briefly discuss the intent of the Atomic Energy Act of 1954.

2. What was the basic purpose of the original Atomic Energy Commission?

3. What basic measures are stipulated by Federal regulations to avoid misuse of nuclear fuels by special interest groups?

4. Name the two bodies that were established as a result of the Energy Reorganizatien Act of 1974.

   a. _____

   b. _____

5. List five factors that the Nuclear Regulatory Commission (NRC) evaluates when determining the acceptability of a proposed site for a nuclear facility.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

6. Briefly discuss the purpose and contents of a Preliminary Safety Analysis Report (PSAR).

_____

_____

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_____

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7. Briefly discuss the purpose and contents of an Environmental Report (ER).

_____

_____

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_____

_____

8. Given a construction permit, describe the safeguards that the owner of a nuclear facility must establish during the construction of the facility.

9. Briefly discuss the contents of the Final Safety Report (FSR).

10. What stipulations must the operating license of a nuclear facility contain?

11. Differentiate between Quality Assurance and Quality Control functions in a nuclear facility. Why is a combination of QA/QC essential to the nuclear industry?

12. Name the main participants, besides the owner, in the licensing process of a nuclear facility.

13. Why do the main participants in the licensing process need a quality assurance program?

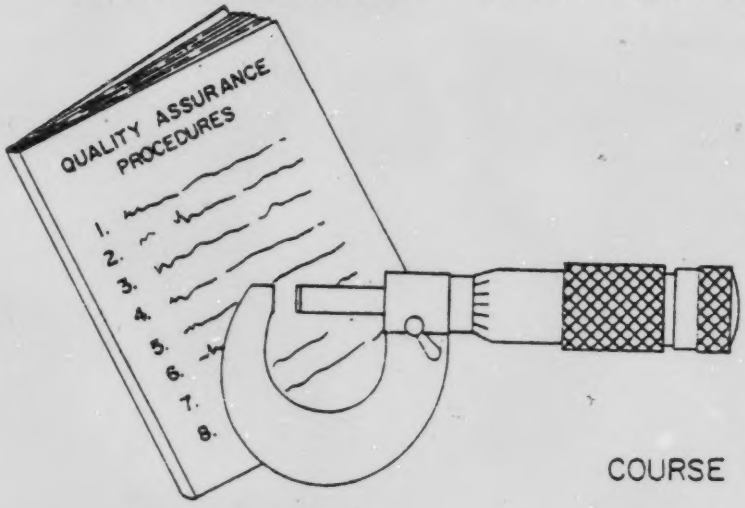
14. How does the American Society of Mechanical Engineers (ASME) affect the QA/QC program of a nuclear facility?

15. Briefly describe the affect nuclear industries' quality assurance programs have had on cost, schedules, and obtaining operating licenses.

NUCLEAR TECHNOLOGY

MODULE 14-2 DEFINITIONS AND DESCRIPTIONS OF QUALITY-ASSURANCE/QUALITY-CONTROL CRITERIA

INTRODUCTION TO
QUALITY ASSURANCE / QUALITY CONTROL



COURSE 14

COURSE MODULES

COURSE 14 INTRODUCTION TO QUALITY ASSURANCE/QUALITY CONTROL

MODULE 14-1	Basic Requirements for Quality Assurance/ Quality Control
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INTRODUCTION

Since first introduced to the nuclear industry in 1969, the idea of quality assurance has been transformed from a basic concept into a practical and working methodology serving the nuclear industry. Quality control, although practical for many decades, even before the birth of the nuclear industry, had to be modified to become an effective part of quality assurance. Among the many reasons for these changes was the fact that Appendix B of 10CFR50 (Eighteen Criteria), required that quality-assurance and quality-control actions be formally documented and traceable through a process of retrieval of information and records of action.

The prevailing era of informal quality-control inspections on traditional assembly lines, in foundries, in manufacturing plants and at construction sites came to a gradual end; a new era of formal, predetermined inspections and tests, with documentation, was launched. This new era is known as that of quality assurance, which includes quality control.

MODULE PREREQUISITES

The student should have completed Module 14-1, "Basic Requirements for Quality Assurance/Quality Control."

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Give a concise definition of quality assurance and quality control, and state basic differences between the two.
2. List titles of NRC's eighteen quality assurance criteria, and state the basic meaning of each.
3. Describe basic duties and responsibilities of quality-assurance and quality-control personnel.
4. Evaluate case study involving a day-to-day conflict-of-interest between quality control and production scheduling.

DEFINITION OF QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance is a new technology introduced to industry to evidence (by documentation and records) that quality has been controlled during production and that the desired excellence is present in products or services so documented.

Quality is that property of an item, object or thing used to identify its degree of excellence, grade or character.

Control is an action taken to check, test or otherwise evidence quality.

Assurance is an action taken to establish certainty or confidence.

Quality control implies those actions taken by quality-control personnel (inspections, checks and other verifications) to ensure that work activities are performed in accordance with approved procedures. The purpose is to ensure that prescribed quality requirements are met.

Quality assurance implies that those actions taken by quality-assurance personnel are documented. It is, in the end, this documentation that signifies the degree of excellence (characteristics to perform satisfactorily in service) embodied in a product or service.

The above definitions introduce new parameters to aid in understanding the achievement of quality.

QUALITY-ASSURANCE PERSONNEL

Individuals with training that qualifies them to audit, check, test, verify and document activities related to quality.

APPROVED PROCEDURES AND METHODS

Written instructions with specific step-by-step directions for performing work activities.

PRESCRIBED QUALITY REQUIREMENTS

Descriptions of what kind and how much quality is required to ensure acceptance of product or work activity.

STANDARD OF QUALITY

Pre-established technical and practical information, specified by competent engineers or designers, to help judge end quality of a product or work activity.

ADEQUATE CONFIDENCE

The result of review and evaluation of all available evidence that testifies to the presence of quality in a product or work activity.

PERFORM SATISFACTORILY IN SERVICE

An evaluation, based on physical as well as other characteristics, that an item will perform acceptably in its intended use.

DOCUMENTATION AND RECORDS

Permanent written instruments that state what control actions were taken, what results were obtained, and how information, in evidencing the existence of quality, may be traced.

It is important to note that quality control and quality assurance do not set standards for quality; they simply perform the necessary functions to verify and attest that the specified quality has been achieved.

EXAMPLE

The design engineer for a concrete foundation, a pump, a piping system, a radiation detector or a nuclear reactor must specify all the parameters that investigations, calculations and studies dictate that an item or activity must have to fulfill its intended function. This data includes materials to be used, skills and techniqures to be employed and tests to be performed and the quality standard to be met. Drawings and specifications must be prepared to cover all these requirements.

Production personnel study the drawings and specifications and prepare procedures that outline work activities in appropriate details. Production personnel are responsible for translating and incorporating these procedures into necessary actions for safeguarding quality (per requirements and specifications).

Quality-control and quality-assurance personnel jointly review production procedures with production personnel; mutually they agree to include inspection points and check points and to identify the necessary stages of production beyond which no work should be performed until verifications have been completed. These procedures, when approved in the above manner, become the working documentation for all concerned.

QA/QC personnel establish inspection and check lists in compliance with approved procedures, and identify the data, records and documents to be prepared. When production begins, QC personnel monitor production progress, checking, testing and inspecting every activity on the list. Dimensional measurements, non-destructive testing and other methods of inspection are employed; results are compared with specified standards before acceptance is made. QA personnel audit QC records to verify that all necessary information is obtained and ensure that such information is traceable to actual work activities performed in production. When all procedures are executed, it becomes possible to attest that each product (or work activity) is

completed in accordance with specifications and will perform satisfactorily in service.

Quality-control activities are carried out concurrent with work activities and should be performed at approximately the same time. Also, work activities are dependent on QC activities; i.e., work should not progress from one stage to another until the necessary QC activities are performed and quality requirements are met.

Quality-assurance activities are not necessarily conducted concurrent with QC or work activities, but may precede them to verify that data and results are properly documented. QA, then, is the final stage of a total quality process.

QUALITY-ASSURANCE CRITERIA

Quality-assurance criteria, as related to the nuclear industry, received their name and fame upon publication, in 1969, of "Quality Assurance Criteria for Nuclear Power Plants" Appendix B of 10CFR50, and "Licensing of Production and Utilization Facilities," by AEC.

These criteria required that every applicant for a nuclear facility construction permit provide a Preliminary Safety Analysis Report (PSAR), which includes

a quality-assurance program to be applied to the design, fabrication, construction and testing of structures, systems and components of the facility.

Also, it required every applicant for an operating license to include in its Final Safety Report (FSR) information pertaining to the managerial and administrative controls to ensure safe operation. Consequently, nuclear power plants include structures, systems and components that prevent or lessen the consequences of any accident that could cause undue risk to public health and safety.

Quality assurance comprises all those planned and systematic actions necessary to provide adequate confidence that structures, systems and components perform satisfactorily in service. Quality assurance includes quality control, which comprises those actions, related to the physical characteristics of material, structure, component or system, which provide means to control quality to predetermined requirements.

Quality-assurance criteria may be summarized as follows:

Organization

This criterion requires that:

Applicant is responsible for establishing and executing a quality-assurance program.

Authority and duties of persons performing QA functions must be clearly established and delineated in writing.

QA personnel must have organizational freedom to identify problems and recommend solutions.

QA personnel must be independent of the individual or

group performing the activity being inspected or controlled by QA.

Quality-Assurance Program

This criterion requires that:

Applicant must establish a QA program that complies with Appendix B (18 Criteria).

QA program must be documented by written policies, procedures or instructions.

Applicant must identify structures, systems and components to be covered by QA program.

Applicant must identify individuals or organizations participating in program and describe their functions.

QA program must provide for indoctrination and training of personnel performing activities affecting quality.

Design Control

This criterion requires that:

Applicable regulatory requirements and design basis (specified in application) must be correctly translated into specifications, drawings, procedures and instructions.

Appropriate quality standards must be specified and included in design documents.

Selection of materials, parts and processes specified in the design must be reviewed for suitability of application.

Interfaces among participating design organizations, if more than one, must be identified and controlled.

Design must be verified and checked by individuals or groups other than those who performed the design.

Design changes and field changes must be subject to the same controls applied to original design and approved by organizations that performed original design.

Procurement Document Control

This criterion requires that:

Procurement or purchasing documents for material, equipment and services must include regulatory requirements and design basics to ensure adequate quality.

Procurement or purchasing performed by subcontractors or agents of applicant must meet the same requirements for procurement as the applicant.

Applicant must require contractors, subcontractors and agents to provide their own QA programs consistent with Appendix B.

Instructions, Procedures and Drawings

This criterion requires that:

All activities affecting quality must be prescribed by documented instructions, procedures or drawings.

All activities affecting quality must be accomplished in accordance with documented instructions, procedures or drawings.

All instructions, procedures and drawings must include appropriate quantitative or qualitative acceptance criteria for determining that activities have been satisfactorily accomplished.

Document Control

This criterion requires that:

Issuance of documents such as instructions, procedures or drawings, including changes thereto, must be established and controlled.

Documents, including changes, must be reviewed and approved by authorized personnel.

Documents must be distributed to and used at location where activities they prescribe are performed.

Changes to documents must be reviewed and approved by same organization that performed original review and approval.

Control of Purchased Material, Equipment and Services

This criterion requires that:

All purchased material, equipment and services must conform to procurement documents.

Sources for supply of material, equipment and services must be evaluated and selected on the basis of objective evidence that quality can be accomplished as required.

Suppliers of material, equipment and services must furnish documentary evidence that requirements of procurement documents have been accomplished.

Documentary evidence must be available at power plant site before installation or use of material or equipment.

Documentary evidence must be retained at power plant site and be sufficient to prove compliance with codes, standards and specifications.

Effectiveness of control of quality by contractors, subcontractor or agents must be assessed by

owner in a manner consistent with importance and complexity of product or service.

Identification and Control of Materials, Parts and Components

This criterion requires that:

All materials, parts and components must be identified and controlled.

All partially fabricated assemblies must be identified and controlled.

Identification of items must be maintained by heat number, part number, serial number or other means, either directly on item or on records traceable to item.

All identification and control measures must be designed to prevent use of incorrect or defective materials, parts and components.

Control of Special Processes

This criterion requires that:

All special processes, including welding, heat treating and nondestructive testing must be identified and controlled.

All special processes must be described in procedures and procedures must be approved and qualified.

All special processes must be accomplished by qualified personnel using qualified procedures.

All special processes must include requirements of (and be qualified in accordance with) applicable codes, standards, specifications, criteria and other special requirements.

Inspection

This criterion requires that:

A program for inspection of activities affecting quality must be established and executed.

All inspections must verify that activities were accomplished in conformance with documented instructions, procedures and drawings.

All inspections must be performed by personnel other than those performing the activity being inspected.

If inspection is impossible or disadvantageous, indirect control by monitoring must be provided.

Work must not proceed beyond a designated inspection point until required inspections are performed and compliance is approved by an authorized individual.

Test Control

This criterion requires that:

A program for testing (required to demonstrate that items perform satisfactorily in service) must be established and executed.

All testing must be performed in accordance with written test procedures, which include the requirements and acceptance limits contained in applicable design documents.

Test procedures must include proof tests prior to installation and operation of item or component.

All test results must be documented and evaluated to ensure that test procedure requirements have been met.

Control of Measuring and Test Equipment

This criterion requires that:

Tools, gages, instruments and other testing devices used in activities affecting quality must be identified and controlled.

Tools, gages, instruments and other testing devices must be calibrated and adjusted at specified periods.

Tools, gages, instruments and other testing devices must be maintained within the limits of accuracy of their intended use.

Handling, Storage and Shipping

This criterion requires that:

Procedures must be established to control handling, storage, shipping, cleaning and preservation of material and equipment to prevent damage and deterioration.

When necessary, for particular products, special protective environments must be provided (such as inert gas atmosphere, controlled moisture levels, temperature levels and others) in accordance with established procedures.

Inspection, Test and Operating Status

This criterion requires that:

Procedures must be established to mark, stamp, tag, label or otherwise indicate status of inspections and tests performed upon items in plant.

Items that have satisfactorily passed required inspections and tests must be properly marked and identified.

Structures, systems and components must be tagged to indicate their operating status and to prevent inadvertent use except as specified.

Nonconforming Materials, Parts and Components

This criterion requires that:

Materials, parts or components that do not conform to specified requirements must be identified and controlled.

Nonconforming items must be segregated, documented and reported to affected organizations for dispositioning.

Nonconformity reports must be prepared to indicate that nonconforming items were reviewed, accepted as is, rejected, repaired or reworked in accordance with documented procedure

Corrective Action

This criterion requires that:

Procedures must be established to identify and correct conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective materials and nonconformances in the work.

Significant conditions, adverse to quality, must be investigated and the causes of such conditions determined and corrective action taken to preclude repetition.

Such significant conditions, their causes and corrective actions taken to prevent their recurrence must be documented and reported to management.

Quality-Assurance Records

This criterion requires that:

Records must be prepared and maintained to furnish evidence of activities affecting quality.

Records of operating logs, results of reviews, inspections, tests, audits and monitorings of work performance must be prepared and maintained.

Records of qualification of personnel, procedures and equipment must be maintained.

Inspection and test records must identify inspector, data recorded, results obtained and actions taken in dealing with deficiencies.

A system must be established to identify, retrieve, retain and specify duration, location and assigned responsibility for care and custody of records.

Audits

This criterion requires that:

A comprehensive system of planned and periodic audits must be carried out to verify compliance with all aspects of quality-assurance program.

Effectiveness of quality-assurance program must be determined and corrective action taken in areas of deficiencies.

All audits must be performed by trained personnel other than those responsible for area being audited.

All audits must be performed in accordance with written procedures and check lists.

All audit results must be documented and reviewed by management having responsibility over area being audited.

Follow-up audits, reaudits and other appropriate actions must be taken in areas of noted deficiencies.

From the above information, it can be concluded that every activity and every action related to nuclear power plant construction, operation and maintenance must be thoroughly evaluated, planned, documented, implemented and recorded by trained, qualified and responsible personnel.

The remainder of this module and modules to follow in this course attempt to express and expand quality assurance and quality control within the scope and intent of the above criteria.

DUTIES AND RESPONSIBILITIES OF QUALITY-ASSURANCE/QUALITY-CONTROL PERSONNEL

Quality-assurance and quality-control personnel are trained individuals responsible for performing a vital function. Although they must retain complete independence while discharging their duties and responsibilities, they still must closely coordinate and schedule their activities with other organizational personnel, especially production personnel.

Many companies have their own quality-assurance/quality-control departments. Other companies contract for these services with firms specialized in training and qualifying quality-assurance/quality-control personnel for specific functions.

In the case of contracted services, communications and coordination of activities with production personnel is a paramount consideration. The obvious reason is

that outside personnel require time and effort to learn the mode of operation of an organization with which they are unfamiliar and in which they are "outsiders." But even if an organization recruits, trains, qualifies and employs its own quality-assurance/quality-control personnel, their duties and responsibilities remain basically the same.

Principal individuals of a sound quality-assurance program include, but are not limited to, the following individuals.

VICE PRESIDENT, QUALITY ASSURANCE

A vice president is a senior officer of an organization. This rank implies authority to establish corporate policy and direct organizational activities in a manner consistent with the guidance of superior officers.

The vice president must instruct appropriate staff individuals to prepare necessary documents to establish a quality-assurance program responsive to needs and commitments of the organization, and in compliance with regulatory and Code requirements. The vice president has authority to establish and implement policies affecting costs, schedules, quality assurance and contractual matters.

DIRECTOR, QUALITY ASSURANCE

A director reports to a vice president and is responsible for development, execution and implementation of corporate quality-assurance policies,

procedures and instructions. A director usually has five years or more of experience in a responsible position involving design, construction or operation of a power plant. Responsibilities of the director include: (1) auditing, on a periodic basis, to ensure compliance with quality-assurance program; (2) taking corrective action when activities do not conform to program requirements; (3) reviewing procurement documents issued to ensure compliance with quality-assurance requirements; and (4) indoctrinating quality-assurance and other personnel involved in quality-related functions. The director maintains a document control system and a library of books, standards, codes, regulatory guides and publications pertinent to quality assurance and nuclear power plants.

The director also recruits, evaluates and hires quality-assurance personnel and assigns a quality-assurance manager for each nuclear project. Other activities include performance and effectiveness reviews of quality-assurance personnel and making appropriate changes, including salary adjustments and project transfers. The director is responsible for interfacing quality-assurance activities with construction activities (as scheduled) to ensure that quality-assurance personnel and quality-assurance procedures are made available at the location where quality activities are to be performed prior to commencing such activities.

The director has authority to instruct the project managers to stop work when materials or work quality are found defective or do not meet requirements prescribed in quality-assurance procedures.

The director submits a monthly quality-assurance report to the vice president, indicating status of quality-assurance programs, including activities at nuclear projects under construction. Problem areas, nonconformance status and overdue, open and unresolved audit findings receive special attention in this quality-assurance report to management. The vice president, construction general manager, project managers, quality-assurance managers and other department managers, as appropriate, receive copies of the quality-assurance report.

Further, the director's responsibility includes:

Preparation, distribution and control of corporate quality-assurance manual.

Coordination with NRC Directorate of Regulatory Operations Division of Compliance.

Directing audit/surveillance activities of construction vendors and supplies to ensure compliance with design drawings and specifications, codes, standards and quality-assurance program.

Supervising reviews of quality-assurance requirements for construction, contracts, procurement documents, vendor evaluations and subcontract documents.

Planning and directing training of quality-assurance managers, quality-assurance engineers, quality-control inspectors and quality-assurance supervisors, and implementing indoctrination of other company personnel in quality assurance as necessary.

Supervising reviews of nonconformance reports and recommended corrective actions, and verification of appropriate dispositioning instructions and implementations.

Supervising reviews of internal and external audit findings and follow-up actions, and recommending follow-up audits.

Recommending (to vice president or president) modifications or revisions to quality-assurance policies as needed or desired.

QUALITY-ASSURANCE MANAGER

The quality-assurance manager reports to the director and is responsible for executing and implementing quality-assurance program, quality-assurance procedures and instructions as may be developed or endorsed for use at a nuclear plant site.

A quality-assurance manager usually has three or more years of experience in a responsible position involving design, construction or operation of power plants.

A quality-assurance manager assigns quality-control inspectors and quality-assurance supervisors to nuclear project sites to assist in discharging project quality-assurance responsibilities.

The quality-assurance manager's activities are coordinated with the project manager to ensure that all activities requiring quality-assurance procedures and work instructions are identified in time to allow quality assurance procedures and work instructions to be

provided prior to commencing activities requiring these procedures.

The quality-assurance manager has authority to advise the project manager to perform repairs, modifications, replacements or reworks when materials, equipment or workmanship are found defective or do not comply with the requirements of quality-assurance procedures or instructions as may be dispositioned by documented and approved nonconformance reports.

The quality-assurance manager has authority to stop work when ordered by the plant owner to do so, or when violations of quality-assurance procedures or instructions are found.

The quality-assurance manager supervises activities and performances of quality-control inspectors and quality-assurance supervisors and submits biweekly reports to the director, summarizing quality-assurance activities. Problem areas, nonconformance status, site audit status and project quality trends are identified in the quality-assurance manager's report.

The plant owner, project manager, appropriate craft superintendents, technical engineers and other designated persons or organizations may be on the report distribution list. Duties of the quality-assurance manager include:

Preparation, distribution and control of project quality-assurance procedures and instructions.

Coordinating activities attendant to plant owner and NRC during site audits.

Conducting audits and surveillance of activities to ensure compliance with quality-assurance procedures, work instructions and guides.

Reviewing project design drawings and specifications, site-initiated procurement documents and subcontractors' activities for conformance with quality-assurance requirements during construction phase.

Maintaining records and status of nonconformances and nonconformance reports, and pursuing implementation of corrective actions and necessary inspections and tests of reworked and repaired items.

Advising director of scheduled project activities and quality-assurance workforce requirements.

Conducting quality-assurance field staff meetings to review status of quality-assurance functions, changes or modifications in regulatory guides, codes, standards and project specifications.

QUALITY-ASSURANCE ENGINEERS

Quality-assurance engineers report to the quality-assurance manager. They are responsible for assuring that administrative functions of quality assurance are in compliance with quality-assurance guides and policies. Quality-assurance engineers usually have three or more years of experience in quality-related positions, involving design, manufacturing or construction.

Quality-assurance engineers process quality-assurance communications from nuclear projects, prepare and submit summary status reports of activities to director or quality-assurance manager, take appropriate

actions when requests for information, technical guidance or approved quality-assurance documentation are received from project personnel.

Quality-assurance engineers conduct reviews of project specifications, procurement requisitions, drafts of quality-assurance procedures and work instructions to ensure compliance with quality-assurance program. They distribute pertinent information from publications, code cases, NRC, interproject experiences and other sources as they become available.

Quality-assurance engineers assist in conducting survey, surveillance and audits, and they participate in research, preparation, review and follow-up of quality-assurance documents as instructed by director.

QUALITY-ASSURANCE SUPERVISORS

Quality-assurance supervisors report to the quality-assurance manager. They are responsible for performing periodic surveillance of quality-related activities and conducting audits of procedures and methods, quality-assurance functions, quality-control records and documents to ensure compliance with quality-assurance program. Quality-assurance supervisors review, inspect, verify and validate quality-control records, vendor or supplier-furnished documents for materials, equipment or services, to ensure that full compliance with approved procedures, work instructions, design drawings and specifications has been achieved.

Quality-assurance supervisors usually have two or more years of experience in quality-related positions,

involving design, manufacturing, maintenance or construction.

Quality-assurance supervisors participate in the generation, review, implementation, audit and control of quality-assurance procedures and work instructions. They maintain logs to reflect status of nonconformances, deviations and audit findings and take action on follow-up, review and closeout of open and unresolved items.

Quality-assurance supervisors are responsible for surveillance and audit of document control at the construction site to ensure that only approved issues or revisions of design drawings and specifications, quality-assurance procedures and work instructions, codes, standards and regulatory requirements are distributed by quality control to appropriate persons or organizations.

QUALITY-CONTROL INSPECTORS

Quality-control inspectors report to the quality-assurance manager. They are responsible for performing surveillance and inspection of quality-related activities to verify that methods, records and data are in accordance with design drawings, specifications, quality-assurance procedures and work instructions. Quality-control inspectors also are responsible for verifying markings, identifications and documentations of materials and equipment during on-site receiving inspection and acceptance.

Quality-control inspectors perform (but not limited to) the following duties:

Sign off of "work-traveler" inspection documents, and "test hold points," beyond which fabrication may not proceed.

Detailed item inspections.

Witnessing of predesignated tests.

Coordination, with other inspection agencies, of ASME Code-related inspections and the like.

Participation in the generation, review, implementation and control of quality-assurance procedures and work instructions.

Issuance of "hold-notice" tags to stop work or activities found to be defective, nonconforming or deviating from approved procedures.

Implementation of document control procedures.

Receiving, logging and distributing design drawings and specifications, quality-assurance procedures and work instructions, codes, standards and regulatory information (and revisions) to appropriate persons and organizations.

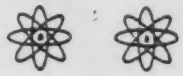
The terms, "work traveler," "test hold points" and "hold notice tags" are quality-control devices used to ensure control, traceability and quality; each is more completely described in later modules.

QUALITY-ASSURANCE SUPPORT STAFF

A quality-assurance support staff may include engineers, technicians, trainees, clerks, typists and others not mentioned previously. This staff must be

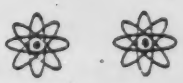
indoctrinated and trained to appropriate levels, commensurate with their assigned duties and responsibilities.

Note: A student of this course may receive a two-year credit (education and/or experience) from most organizations toward employment requirements mentioned above.



EXERCISES

None.



MATERIALS

None.

PROCEDURES

The XYZ Nuclear Fabrication Company is producing reactor vessel flange nuts and bolts for a nuclear power reactor vessel. During the first shift, at 3:00 p.m., Mr. Hadley, a quality-control inspector with ten years of QC experience, checks a bolt and finds that two of its dimensions do not meet drawing dimensions. Immediately he places a hold tag on that part, then notifies his supervisor and the machine operator of the problem. The machine operator, who has been instructed by her supervisor in the production department that four of these bolts must be shipped by 4:00 p.m. today to avoid a cost penalty to the company, continues to machine three more; upon inspection, these three also are found to be nonconforming in the same two dimensions.

Divide class into two groups (A and B); appoint a speaker for each group. Group A must represent the quality-assurance/quality-control department; and Group B must represent the production department.

List and present major steps required of each group to:

Define the real problem(s).

Resolve the problem(s).

Decide what corrective actions need to be implemented in the quality-assurance/quality-control and production departments to prevent recurrence of the problem.

Note: Add any other problem parameter that amplifies scope of this case study.

DATA TABLE

None.

REFERENCE MATERIALS

U. S. Atomic Energy Commission. "Quality Assurance Criteria for Nuclear Power Plants." Code of Federal Regulations, Title 10-Atomic Energy. Federal Register.

Available by writing the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402.

Read each question carefully. Be sure to provide the specific information each question requires. Make your answers brief. Use the backs of the test if you need more space.

1. Describe the major duties of the following quality assurance and quality control personnel.

   a. Vice President, Quality Assurance: _____

   b. Director, Quality Assurance: _____

1. c. Quality Assurance Manager: _____

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d. Quality Assurance Engineers: _____

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1. e. Quality Assurance Supervisors: _____

f. Quality Control Inspectors: _____

2. List the titles of the Nuclear Regulatory Commission's eighteen quality assurance criteria (as specified in Appendix B, 10 CFR 50).

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

i. _____

j. _____

k. _____

l. _____

m. _____

n. _____

o. _____

p. _____

q. _____

r. _____

3. State the basic requirements for any six (6) criteria you listed in Question #2.

4. Define quality assurance and quality control and state any basic differences between the two.

5. Analyze the case study on the next page and answer these questions about it:

   a. What is the major problem(s)?

   b. What actions could the production manager have taken to prevent the problem?

5. c. What actions could the quality control manager have taken to prevent the problem?

_____

_____

_____

_____

_____

_____

QUESTION #5 CASE STUDY

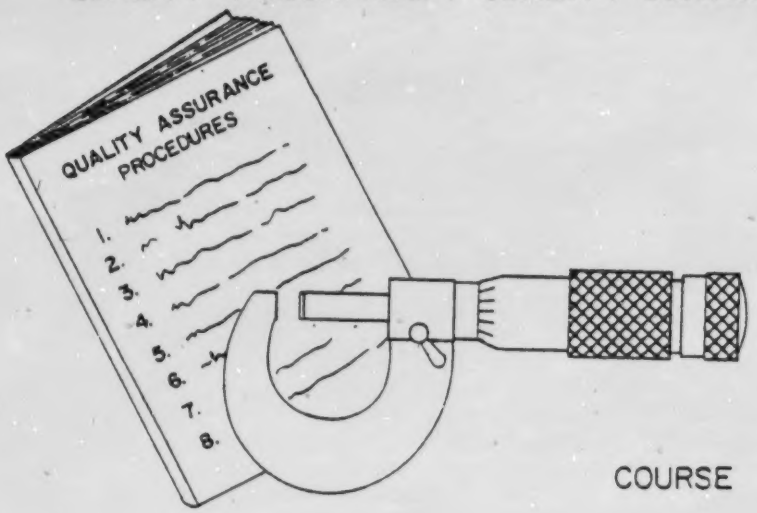
A construction contractor is installing pressure piping in a safety related system during the construction of a nuclear power plant. Each piping joint is welded and required to be radiographed. The contractor has placed a purchase order with a subcontractor for installing thermal insulation around the piping. The purchase order stipulates that the subcontractor must begin work on September 11 and complete the work by September 29 in order to maintain the plant construction schedule. On September 6, the construction contractor's production department manager notes that 72 of the necessary 80 welds have been made but only 40 of the 72 have been radiographed. The production manager issues a memo to the quality control manager requesting that all radiography be completed prior to September 11. In a meeting September 12, the production manager, the quality control manager, and the subcontractor, determine the following:

- All welding was completed on September 8.
- Radiography of each weld joint was completed on September 10.
- At the start of subcontractor work on September 11, only 90% of the radiographs had been evaluated.
- Evaluation of the remaining radiographs on September 11 and 12 revealed that two welds had defects in need of repair.
- Both of the nonconforming welds had been covered with thermal insulation on September 11.
- The subcontractor estimated an additional charge of $9,000 because of the need to remove insulation to permit repair welding and re-radiography and to reinstall insulation.

NUCLEAR TECHNOLOGY

MODULE 14-3 GOVERNMENTAL REGULATION OF QUALITY ASSURANCE/ QUALITY CONTROL (AEC, NRC)

INTRODUCTION TO
QUALITY ASSURANCE / QUALITY CONTROL



COURSE 14

COURSE MODULES

COURSE 14 INTRODUCTION TO QUALITY ASSURANCE/QUALITY CONTROL

MODULE 14-1	Basic Requirements for Quality Assurance/ Quality Control
MODULE 14-2	Definitions and Descriptions of Quality Assurance/Quality Control Criteria
MODULE 14-3	Governmental Regulation of Quality Assurance/Quality Control (AEC, NRC)
MODULE 14-4	Technical Regulation of Quality Assurance/ Quality Control (ASME, ANSI)
MODULE 14-5	Implementation of Quality Assurance/ Quality Control Programs and Procedures
MODULE 14-6	Application of Quality Assurance/Quality Control to Industry
MODULE 14-7	Techniques and Variations in Quality Assurance/Quality Control
MODULE 14-8	Quality Assurance/Quality Control Records and Documents
MODULE 14-9	Special Studies in Quality Assurance/ Quality Control

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INTRODUCTION

The nuclear industry opened up new frontiers by converting use of the atom from military to civilian applications in the 1950's and following decades. Previous military uses caused considerable attention to be focused on all nuclear activities, and mandated a safe and reliable transition. This transition created a need for augmented efforts to develop and apply improved quality-assurance practices. The industry, including design engineers, manufacturers, suppliers and constructors agreed with the regulators that nuclear power was complex and that strict procedures were essential to minimize errors and ensure compliance with acceptable manufacturing, construction and operation criteria.

Among the many rules and regulations enacted by the Government in this area were the "quality assurance criteria" and other related documents, such as the "rainbow" series and regulatory guides.

MODULE PREREQUISITES

The student should have read Module 14-1, "Basic Requirements for Quality Assurance/Quality Control in the Nuclear Industry," and Module 14-2, "Definitions and Descriptions of Quality Assurance/Quality Control Criteria."

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Summarize, in a few sentences, the history of the Atomic Energy Commission (AEC) and its duties and responsibilities to the public.
2. Describe the Nuclear Regulatory Commission (NRC) as well as its duties and responsibilities.
3. Describe the Code of Federal Regulations and Appendix B of 10CFR50.
4. Name the books in the "Rainbow" Series and describe the purpose of each.
5. Define the Regulatory guides, describe their development and explain their purpose.
6. Explain how the Regulatory Guide is used in controlling quality-assurance and quality-control activities.

EVOLUTION OF COMMERCIAL NUCLEAR PROGRAMS

In the post World War II era, the United States Navy designed and constructed many of the early nuclear reactors. Many industries, contracted to supply the Navy with nuclear equipment, components, parts and services, had to make significant adjustments in their organizational structures, operating procedures and production methods to comply wath Navy specifications. The quality required of the Navy for nuclear products was excellent.

Because their nuclear reactors were vital sources of energy for defense, our country focused attention on both quality and reliability. Soon the Government and industry began to focus efforts upon the development of nuclear reactors for electric generating power plants.

THE ATOMIC ENERGY COMMISSION (AEC)

The Atomic Energy Act of 1954 stipulated that the President of the United States would appoint a chairman and four commissioners to discharge the duties and responsibilities of the AEC. The AEC was charged with regulating the nuclear industry and making certain that nuclear power would cause no danger to public life, health or property.

The licensing process for nuclear facilities was established by AEC. Its intent was to ensure that only those who demonstrate full compliance with all the laws, rules and regulations would be granted licenses to own, construct and operate nuclear reactors. The owner of a facility, or proposed facility, was required to work very closely with the Commission and its regulators and numerous branches. Main branches of AEC's included:

The Division of Reactor Licensing.
The Division of Compliance.
The Division of Reactor Operation.

The AEC had five (5) geographic regional offices to serve the industry on a timely basis; however, most, if not all, decisions were made or confirmed through the Washington, D. C., headquarters.

Each of the above mentioned divisions included numerous departments and many functional groups. In each instance, quality assurance played an important role.

Until 1969, the rules and regulations of AEC required that all activities affecting the design, manufacture, construction and operation of a safety related structure, system or component of nuclear power be of a "quality commensurate with its intended use or application." It was not until April, 1969, however, that Appendix B, 10CFR50 was published to provide the nuclear industry with specific guidelines for quality assurance.

It should be pointed out that AEC personnel responsible for enforcing the laws had as much difficulty as industry itself in interpreting and implementing the provisions of Appendix B. As these difficulties

continued to trouble everyone, a consensus was reached among all concerned that additional information was necessary. Such information was derived from public hearings, industry-government sponsored seminars, technical standards, guides and other documents. This joint effort of industry and Government created a significant turn-around in making quality assurance a useful and reliable process.

THE NUCLEAR REGULATORY COMMISSION (NRC)

The Energy Reorganization Act of 1974 consolidated certain nuclear development functions in a new Energy Research and Development Administration (ERDA) and others in a new Nuclear Safety and Licensing Commission (NSLC). The intent was to promote more efficient management of matters concerning the nation's energy needs.

The NSLC has a chairman and four members appointed by the President and confirmed by the Senate. The reorganization further separated the regulatory functions (from the development and promotion of new technology for the industry) by establishing the Nuclear Regulatory Commission (NRC).

The regulatory functions of the AEC were preserved and transferred to the NRC. These functions included:

Reactor licensing.
Reactor enforcement.
Reactor operation.

Many of the documents and records available to the industry, though they still bear the name of the Atomic Energy Commission, remain valid.

The Energy Research and Development Administration (ERDA) assumed the function of the AEC in developing nuclear technology; also, it assumed new duties to develop other sources of energy for the nation's self sufficiency. In November, 1977, ERDA became a part of the Department of Energy (DOE).

CODE OF FEDERAL REGULATIONS, 10CFR50

The Code of Federal Regulations (CFR) is published daily, Monday through Friday (except Federal holidays), by National Archives and Records Service, General Services Administration (Washington, D.C.), under the Federal Register Act.

The Federal Register provides a uniform system of making available to the public all regulations and legal notices issued by Federal agencies, including Presidential proclamations and executive orders, Federal agency documents having general applicability and legal effect, documents required to be published by Acts of Congress and other Federal agency documents of interest.

The Code of Federal Regulations is organized by titles, chapters and parts. Title 10 has been designated for energy; Chapter 1 of Title 10 has been designated for atomic energy; Part 50 of Chapter 1 has been designated for licensing of production and utilization facilities.

Because the original issue of Title 10CFR50 did not include provisions for quality assurance, an appendix was added: therefore, Appendix B of 10CFR50 presents the quality-assurance criteria for nuclear power plants.

NRC RAINBOW-COLORED BOOKS ("RAINBOW" SERIES)

A series of rainbow-colored books were prepared and issued by the regulatory staff of the Directorate of Licensing and Operation of the Atomic Energy Commission. These books, bound in gray, green, orange and yellow covers, are commonly known as the "rainbow" series.

GRAY BOOK

The results of a combined effort of Government and industry to streamline nuclear construction programs were manifested in the publication of new quality-assurance documents, compiled by AEC. The first gray book, presented to industry in June, 1973, was titled, "Guidance on Quality Assurance Requirements During Design and Procurement Phase of Nuclear Power Plants."

The gray book became a most valuable source of information on quality-assurance requirements for those involved in the design of nuclear facilities

as well as those involved in material procurements and equipment manufacture. It establishes the Government's positions on several key issues concerning the review process for nuclear license applications. And, it clarified for industry what the Commission was looking for in an application so that one might be processed in a relatively short time.

Among the most important innovations of the gray book is a provision for holding meetings between the regulatory staff and an applicant for a license. During these meetings the regulatory staff must inform the applicant of requirements for quality assurance. Such a meeting must be held six to nine months prior to the date on which application is to be filed with Commission. Free communications during such meetings ensure that quality-assurance requirements are accurate and comprehensively detailed. Proceedings in these "preliminary review" meetings are informal, and any deficiency discovered in applicant's program may be corrected without obligation.

The industry, as a whole, welcomed this new rule and applauded the regulatory staff's interest in reducing the licensing process time.

Another important aspect of the gray book is its recognition and endorsement (by the Commission) of the American National Standards Institute (ANSI) standards on quality assurance.

GREEN BOOK

The "green book," issued in May, 1974, as another in the "rainbow" series, was titled, "Guidance on

Quality Assurance Requirements During the Construction Phase of Nuclear Power Plants." Its purpose was to provide guidance concerning establishment and execution of quality-assurance programs for construction of nuclear power plants. Construction includes such activities as fabrication and manufacturing of nuclear related equipment and components, as well as site activities involving erection and installation.

The green book provides constructors, manufacturers and others involved in the construction phase of nuclear power plants with a unified set of procedures delineating NRC requirements for quality assurance. It also clarified, for the first time, NRC policy on methods of establishing a quality-assurance program to meet the intent and requirements of Appendix B, 10CFR50.

Furthermore, the green book, which began where the gray book left off, addressed quality assurance at the point where design and procurement became complete. Again, the regulatory staff of the Directorate of Licensing and Operation revealed to industry its position on the ANSI Standards and Regulatory Guides that affected construction of nuclear power plants. In so doing, this staff endorsed numerous ANSI Standards then in existence and made many constructive comments on others in the development stage. This effort was intended to streamline, standardize and speed up the time consuming and complicated licensing procedures.

NRC endorsements of ANSI Standards and other codes allowed industry to prepare its quality-assurance programs with confidence and certainty. Previously, constructors and manufacturers had to prepare their

programs from available information with a degree of uncertainty as to whether or not the regulatory review would credit their programs or sources.

Consequently, the green book has become an important document. It must be noted, however, that neither the gray book nor the green book guarantees acceptance of any given quality-assurance program. Rather, they assure the applicant that, if the format and referenced information complies with requirements, the review will be limited to the substantive issues of the program.

ORANGE BOOK

An orange book, issued in October, 1973, as another in the "rainbow" series is titled, "Guidance on Quality Assurance Requirements During the Operations Phase of Nuclear Power Plants." Its purpose was to provide guidance in the establishment and execution of a quality-assurance program for testing and operation of a nuclear power plant. Appendix B, 10CFR50, requires that the design, construction and operation of safety-related structures, systems and components of nuclear power plants have a quality-assurance program with clear and concise measures for protecting public health and safety.

The orange book, in addition to adopting requirements of the gray book, delineated requirements and qualifications of testing, inspecting and operating personnel. NRC considers that operating a nuclear power plant requires an ongoing program of design changes, procurement activities and repair and replacement of

parts; therefore, controls and procedures for assuming the quality of a plant must be safeguarded.

The orange book clarifies regulatory positions on quality-assurance requirements and specifies documentation and national standards acceptable to the NRC. Also, the orange book includes provisions for selecting, training and qualifying reactor operators, and for licensing these individuals. These provisions are fully covered by 10CFR55, entitled "Operators' Licenses."

The orange book introduces regulatory guidance for "Pre-Operational and Initial Start-Up Test Program for Water-Cooled Power Reactors." This guidance has been welcomed by plant owners because it provides them with badly needed information on regulatory positions, test program descriptions and acceptance criteria.

YELLOW BOOK

A yellow book, issued in May, 1974, is titled, "Status Summary Report - Data for Decisions." The Commission felt that it would be helpful to both industry and NRC to establish a procedure for monitoring progress of plant construction by noting all significant scheduled changes that might alter fuel loading dates and affect issuance of an operating license.

In the late 1960's and early 1970's, at least 65 nuclear power plants were under construction simultaneously in the United States. During this same period of time, NRC was experiencing workforce

shortages that affected its ability to perform timely application reviews and construction inspections. Therefore, the program of construction schedule monitoring provided in the yellow book helped the allocation and distribution of NRC workforce resources.

The industry recognized the potential benefits of the program and cooperated to the fullest extent possible. Licensees acted as liaisons between NRC and other members of industry involved in scheduled construction activities and preparing fuel loading data.

The "rainbow" series of books provided one of the most important and significant innovations in quality assurance since the publication of Appendix B 10CFR50. It provided industry and regulators with valuable procedures, including the following:

Specific requirements for quality-assurance activities considered essential for licensing.

Specific ANSI Standards on quality assurance were recognized and endorsed by NRC and, thereby, made a part of the review and evaluation process of quality-assurance programs.

Specific Regulatory Guides on quality assurance and licensing were made a part of the regulations.

THE NRC REGULATORY GUIDES

Until 1973, the Directorate of Regulations communicated with industry through information published

in documents called "Safety Guides." These guides were mailed to subscribers free of charge. They contained information regarding AEC policy on problems, and solutions concerning safety issues of power plants. The initial issues contained mainly information on safeguards and safety of nuclear structures, systems and components.

In 1973, as a result of AEC efforts to streamline and organize the entire licensing process of nuclear power, it became necessary for the Commission to communicate with industry on several issues not particularly limited to safety and safeguards. Therefore, a new approach was devised: the guides were replaced by a new publication called Regulatory Guide.

Regulatory guides describe and make available to the public, methods acceptable to the regulatory staff for implementing specific parts of the Commission's regulations. The guides are intended to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants for nuclear permits.

The Commission emphasizes that the guides are not substitutes for regulations, and compliance with them is not mandatory; however, methods and solutions different from those set out in the guides are acceptable only if they provide the necessary requisites for compliance with regulations.

The Regulatory Guides cover ten broad areas of interest:

Power reactors.
Research and test reactors.

Fuels and materials facilities.
Environment and siting.
Materials and plant protection.
Products.
Transportation.
Occupational health.
Anti-trust reviews.
General.

Regulatory Guides have contributed significantly to standardizing quality-assurance requirements and methods of presentation. Regulatory Guide 1.70, first issued in February, 1972, and twice revised is titled, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants" (Light Water Reactors). It provides industry with a standard format for preparing Preliminary Safety Analysis Reports (PSAR). This format allows the regulatory staff to perform their reviews rather easily, and respond with their comments to the applicant in a relatively short time. Also, applicants have found that the format simplifies task of accumulating data and preparing the PSAR.

It should be pointed out that all Regulatory Guides proposed for issue are submitted to the public and industry for comments 60 days prior to being issued. All comments received by the Commission are reviewed and evaluated and, if appropriate, incorporated into the guides before its official issue.

EXERCISES

None.

MATERIALS

None.

PROCEDURES

1. Obtain Title 10CFR50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants," and read the latest revisions affecting the Criteria. Write a summary to the revision of Criterion 1 - Organizations: state what you think of the changes.
2. Obtain a gray book (any edition), a green book and an orange book:
   List titles and numbers of Regulatory Guides incorporated into each book.
   List titles and numbers of ANSI Standards incorporated into each book.
   Write, in your own words, the most important feature of each book and its significance to the industry.

3. From an index to the Regulatory Guides, Division 1, Power Reactors, select a guide for case study; obtain selected guide (from library); review it and write a summary of the following:

   Purpose and intent of guide.

   Endorsements or exceptions to ANSI Standards named in guide.

To familiarize student with some of the documents mentioned, facsimiles from the Federal Register, "rain bow" series, and Regulatory Guides are appended to this module.

DATA TABLE

None.

REFERENCE MATERIALS

Federal Register 39, No. 1-22, January 1974, 1-4053.

U. S. Atomic Energy Commission. "Quality Assurance Criteria for Nuclear Power Plants." Code of Federal Regulations, Title 10 - Atomic Energy, Federal Register 35, No. 125, June 1970.

_____. "Guidance on Quality Assurance Requirements During the Construction Phase of Nuclear Power Plants." Rainbow Series, Green Book. May 1974.

_____. "Guidance on Quality Assurance Requirements During Design and Procurement Phase of Nuclear Power Plants," Revision 1. Rainbow Series, Gray Book. May 1974.

_____. "Guidance on Quality Assurance Requirements During the Operations Phase of Nuclear Power Plants." Rainbow Series, Orange Book. October 1973.

_____. "Status Summary Report: Data for Decisions." Rainbow Series, Yellow Book. May 1974.

U.S. Congress. Senate. Energy Reorganization Act of 1974. Report No. 93-980. 93rd Cong., 2nd sess., June 1974.

U.S Nuclear Regulatory Commission. "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants," Revision 2. LWR Edition, NUREG 75/094, September 1975.

All documents listed above are available by writing the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

APPENDIX

Facsimiles from Federal Register,
"Rainbow" Series and Regulatory Guides.

August 11, 1972

SAFETY GUIDE 30

QUALITY ASSURANCE REQUIREMENTS FOR THE INSTALLATION, INSPECTION, AND TESTING OF INSTRUMENTATION AND ELECTRIC EQUIPMENT

A. Introduction

Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," establishes quality assurance requirements for the design, construction, and operation of nuclear power plant structures, systems, and components. This safety guide describes an acceptable method of complying with the Commission's regulations with regard to the quality assurance requirements for the installation, inspection, and testing of nuclear power plant instrumentation and electric equipment.

B. Discussion

Working Group N45-3.4 (formerly ad hoc committee N45-3.4, also designated ad hoc committee JCNPS/AH3 by the IEEE) of the American National Standards Institute Standards Committee N45, Reactor Plants and Their Maintenance, has developed a standard which includes quality assurance requirements for the installation, inspection, and testing of nuclear power plant instrumentation and electric equipment. This standard was approved by subcommittee N45-3, Nuclear Quality Assurance Standards, of the American National Standards Committee N45, and the full committee and its Secretariat, and it was subsequently approved and designated N45.2.4-1972 by the American National Standards Institute on March 1, 1972.

This standard was also approved by the IEEE Standards Committee on September 16, 1971, and was designated IEEE Std 336-1971.

C. Regulatory Position

The requirements for the installation, inspection, and testing of nuclear power plant instrumentation and electric equipment which are included in ANSI N45.2.4-1972, "Installation, Inspection, and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Stations" (also designated as IEEE Std 336-1971)[1] are generally acceptable and provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50, subject to the following:

1. ANSI N45.2.4-1972 should be used in conjunction with ANSI N45.2-1971, "Quality Assurance Program Requirements for Nuclear Power Plants." (It is expected that future revisions of ANSI N45.2.4-1972 will include this provision.)

2. Section 9 of ANSI N45.2.4-1972 lists additional guides and standards made applicable by ANSI N45.2.4. The specific applicability or acceptability of these listed guides and standards has been or will be covered separately in other safety guides or in appropriate Commission regulations.

3. Although subdivision 1.1 of ANSI N45.2.4-1972 states that the requirements promulgated apply during the construction phase of a nuclear power plant, these requirements are also to be considered applicable for the installation, inspection, and testing of instrumentation and electric equipment during the operation phase of a nuclear power plant.

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[1] Copies may be obtained from either the Institute of Electrical and Electronics Engineers or the American Society of Mechanical Engineers, United Engineering Center, 345 E. 47th Street, New York, N.Y. 10017.

U.S. NUCLEAR REGULATORY COMMISSION

REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

Revision 1
September 1975

REGULATORY GUIDE 1.79

PREOPERATIONAL TESTING OF EMERGENCY CORE COOLING SYSTEMS FOR PRESSURIZED WATER REACTORS

A. INTRODUCTION

General Design Criterion 1, "Quality Standards and Records," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires that structures, systems, and components of nuclear power plants important to safety be tested to quality standards commensurate with the importance of the safety functions to be performed. Criterion XI, "Test Control," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 requires that a test program be established to ensure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed.

Regulatory Guide 1.68, "Preoperational and Initial Startup Test Programs for Water-Cooled Power Reactors," describes a method acceptable to the NRC staff for complying with the Commission's regulations with regard to preoperational testing of nuclear power plant structures, systems, and components that perform safety-related functions.

This guide describes a preoperational test program acceptable to the staff specifically for emergency core cooling systems (ECCS) in pressurized water reactor power plants. Although this guide is applicable to all pressurized water reactors, certain aspects may not be completely applicable to specific nuclear steam supply designs. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

*Lines indicate substantive changes from previous issue.

B. DISCUSSION

The NRC staff has concluded as a result of recent inspections and reviews of safety analysis reports and startup reports that additional guidance should be provided regarding the scope and reporting of ECCS preoperational testing identified in paragraph 9, "Emergency Core Cooling Systems," of Appendix A to Regulatory Guide 1.68.

C. REGULATORY POSITION

A comprehensive preoperational test program on the emergency core cooling system and its components should be performed to provide assurance that the ECCS will accomplish its intended function when required. The program should cover all test-related activities including:

1. The development of test descriptions, test objectives, and specific acceptance criteria;

2. The preparation of test procedures;

3. Conduct of the tests and acquisition of system and component performance data; and

4. Resolution of deficiencies and deviations from expected performance.

1. System Testing

The preoperational testing of emergency core cooling systems should include the tests described below.

USNRC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the NRC staff of implementing specific parts of the Commission's regulations, to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience. This guide was revised as a result of substantive comments received from the public and additional staff review.

Comments should be sent to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Section.

The guides are issued in the following ten broad divisions:

1. Power Reactors
2. Research and Test Reactors
3. Fuels and Materials Facilities
4. Environmental and Siting
5. Materials and Plant Protection
6. Products
7. Transportation
8. Occupational Health
9. Antitrust Review
10. General

Copies of published guides may be obtained by written request indicating the divisions desired to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director, Office of Standards Development.

U.S. ATOMIC ENERGY COMMISSION

October 1973

REGULATORY GUIDE

DIRECTORATE OF REGULATORY STANDARDS

REGULATORY GUIDE 1.61

DAMPING VALUES FOR SEISMIC DESIGN OF NUCLEAR POWER PLANTS

A. INTRODUCTION

Criterion 2, "Design Bases for Protection Against Natural Phenomena," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires, in part, that nuclear power plant structures, systems, and components important to safety be designed to withstand the effects of earthquakes. Proposed Appendix A, "Seismic and Geologic Siting Criteria," to 10 CFR Part 100, "Reactor Site Criteria," would require, in part, that suitable seismic dynamic analysis, such as a time-history or spectral response analysis, be performed to demonstrate that the structures, systems, and components important to safety will remain functional in the event of a Safe Shutdown Earthquake (SSE). This guide delineates damping values acceptable to the AEC Regulatory staff to be used in the elastic modal dynamic seismic analysis of Seismic Category I[1] structures, systems, and components. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

The energy dissipation within a structure due to material and structural damping while it is responding to an earthquake depends on a number of factors such as types of joints or connections within the structure, the structural material, and the magnitude of deformations experienced. In a dynamic elastic analysis, this energy dissipation usually is accounted for by specifying an amount of viscous damping that would result in energy dissipation in the analytical model equivalent to that expected to occur as a result of material and structural damping in the real structure.

After reviewing a number of applications for construction permits and operating licenses and after reviewing pertinent literature including Reference 1, the AEC Regulatory staff has determined as acceptable, for interim use, the modal damping values shown in Table 1 of this guide. These modal damping values should be used for all modes considered in elastic spectral or time-history dynamic analyses. Values are tabulated for the two earthquakes, the Safe Shutdown Earthquake and the Operating Basis Earthquake (or ½ the Safe Shutdown Earthquake), for which nuclear power plants are required to be designed as specified in proposed Appendix A to 10 CFR Part 100, "Seismic and Geologic Siting Criteria."

C. REGULATORY POSITION

1. The modal damping values expressed as a percentage of critical damping shown in Table 1 of this guide should be used for viscous modal damping for all modes considered in an elastic spectral or time-history dynamic seismic analysis of the Seismic Category I structures or components specified in the table. The modal damping values specified in Table 1 are for use in the dynamic analyses associated with two different magnitudes of earthquakes, the Safe Shutdown Earthquake and the Operating Basis Earthquake (or ½ the Safe Shutdown Earthquake). These analyses would be required by proposed Appendix A to 10 CFR Part 100, "Seismic and Geologic Siting Criteria."

2. Damping values higher than the ones delineated in Table 1 of this guide may be used in a dynamic seismic analysis if documented test data are provided to support higher values.

[1] Structures, systems, and components of a nuclear power plant that are designated as Seismic Category I are designed to withstand the effects of the Safe Shutdown Earthquake (SSE) and remain functional (see Regulatory Guide 1.29, "Seismic Design Classification").

USAEC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the AEC Regulatory staff of implementing specific parts of the Commission's regulations, to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

Published guides will be revised periodically, as appropriate, to accommodate comments and to reflect new information or experience.

Copies of published guides may be obtained by request indicating the divisions desired to the U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention: Director of Regulatory Standards. Comments and suggestions for improvements in these guides are encouraged and should be sent to the Secretary of the Commission, U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention: Chief, Public Proceedings Staff.

The guides are issued in the following ten broad divisions:

1. Power Reactors
2. Research and Test Reactors
3. Fuels and Materials Facilities
4. Environmental and Siting
5. Materials and Plant Protection
6. Products
7. Transportation
8. Occupational Health
9. Antitrust Review
10. General

U.S. NUCLEAR REGULATORY COMMISSION

Revision 2
June 1976

REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

REGULATORY GUIDE 1.64

QUALITY ASSURANCE REQUIREMENTS FOR THE DESIGN OF NUCLEAR POWER PLANTS

A. INTRODUCTION

Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," establishes overall quality assurance requirements for the design, construction, and operation of safety-related structures, systems, and components of nuclear power plants. This guide describes a method acceptable to the NRC staff for complying with the Commission's regulations with regard to quality assurance requirements for the design of all types of nuclear power plants. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

Working Group N45-2.11 of the American National Standards Committee N45, Reactor Plants and Their Maintenance, has prepared a standard that delineates requirements and recommendations for establishing and executing a quality assurance program for the design of nuclear power plants. This standard was approved by subcommittee N45-2, Nuclear Quality Assurance Standards, of the American National Standards Institute Committee N45 and the full committee and its secretariat. It was subsequently approved and designated N45.2.11-1974 by the American National Standards Institute on June 6, 1974.

Revision 1 to Regulatory Guide 1.64, which endorsed ANSI N45.2.11-1974, was published in February 1975. As a result of comments received on the guide and additional staff review, the staff has developed Revision 2. The only significant change in the regulatory position involves position C.2 concerning performance of design verification by supervisors.

*Lines denote substantive changes from previous issue.

C. REGULATORY POSITION

The requirements and recommendations for establishing and executing a quality assurance program during the design phase of nuclear power plants that are included in ANSI N45.2.11-1974* are acceptable to the NRC staff and provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50, subject to the following:

1. Subdivision 1.5 of ANSI N45.2.11-1974 states that other documents that are required to be included as a part of this standard will be identified at the point of reference and described in Section 12 of the standard. The specific acceptability of these listed documents has been or will be covered separately in other regulatory guides or in Commission regulations where appropriate.

2. Instead of the second sentence of the second paragraph of Section 6.1 on design verification, the following should be used: "The duties of a 'supervisor' and the relationship with subordinates vary widely in different organizations. Regardless of their title, individuals performing design verification should not (1) have immediate supervisory responsibility for the individual performing the design, (2) have specified a singular design approach, (3) have ruled out certain design considerations, or (4) have established the design inputs for the particular design aspect being verified. While design verification by the designer's immediate supervisor is encouraged, it should not be construed that such verification constitutes the required independent design

*ANSI N45.2.11-1974, "Quality Assurance Requirements for the Design of Nuclear Power Plants," may be obtained from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017.

USNRC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the NRC staff of implementing specific parts of the Commission's regulations, to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience. This guide was revised as a result of substantive comments received from the public and additional staff review.

Comments should be sent to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Section.

The guides are issued in the following ten broad divisions:

1. Power Reactors
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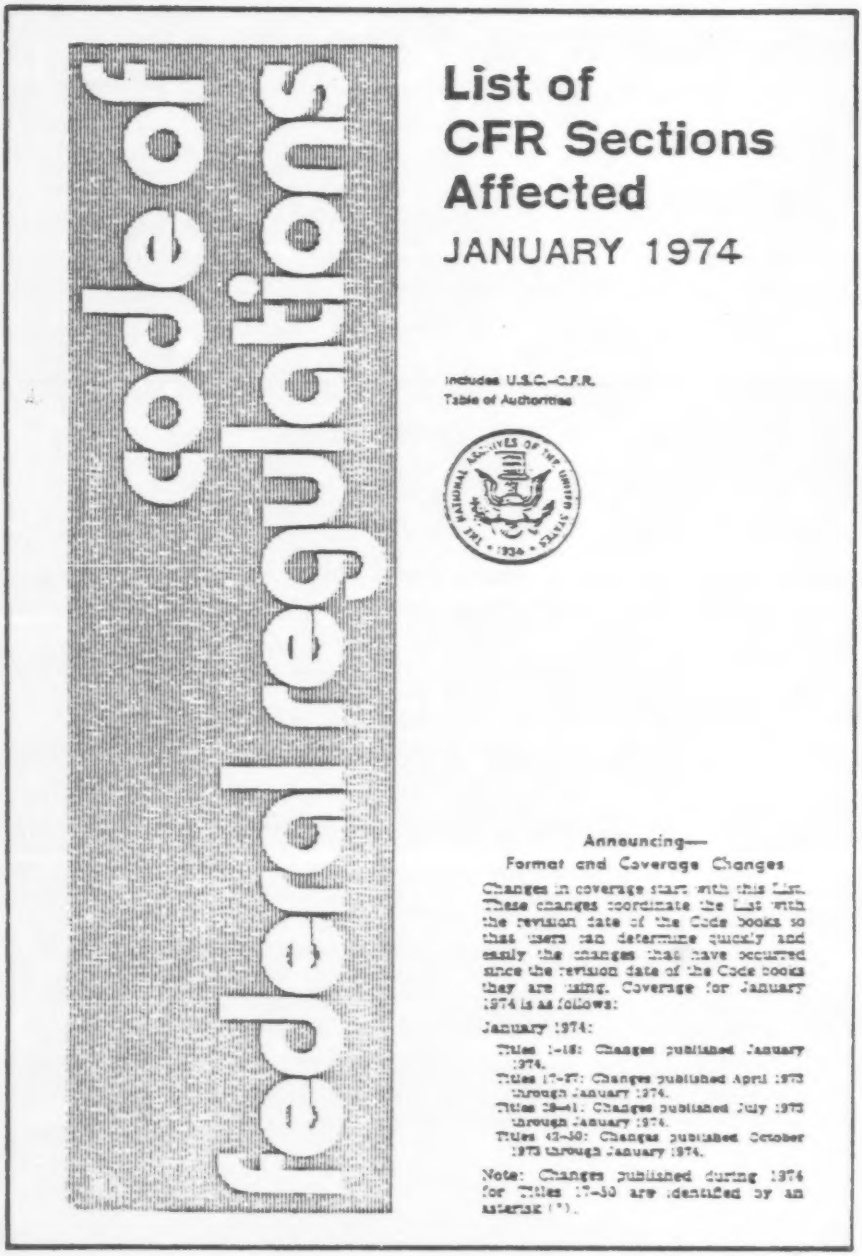
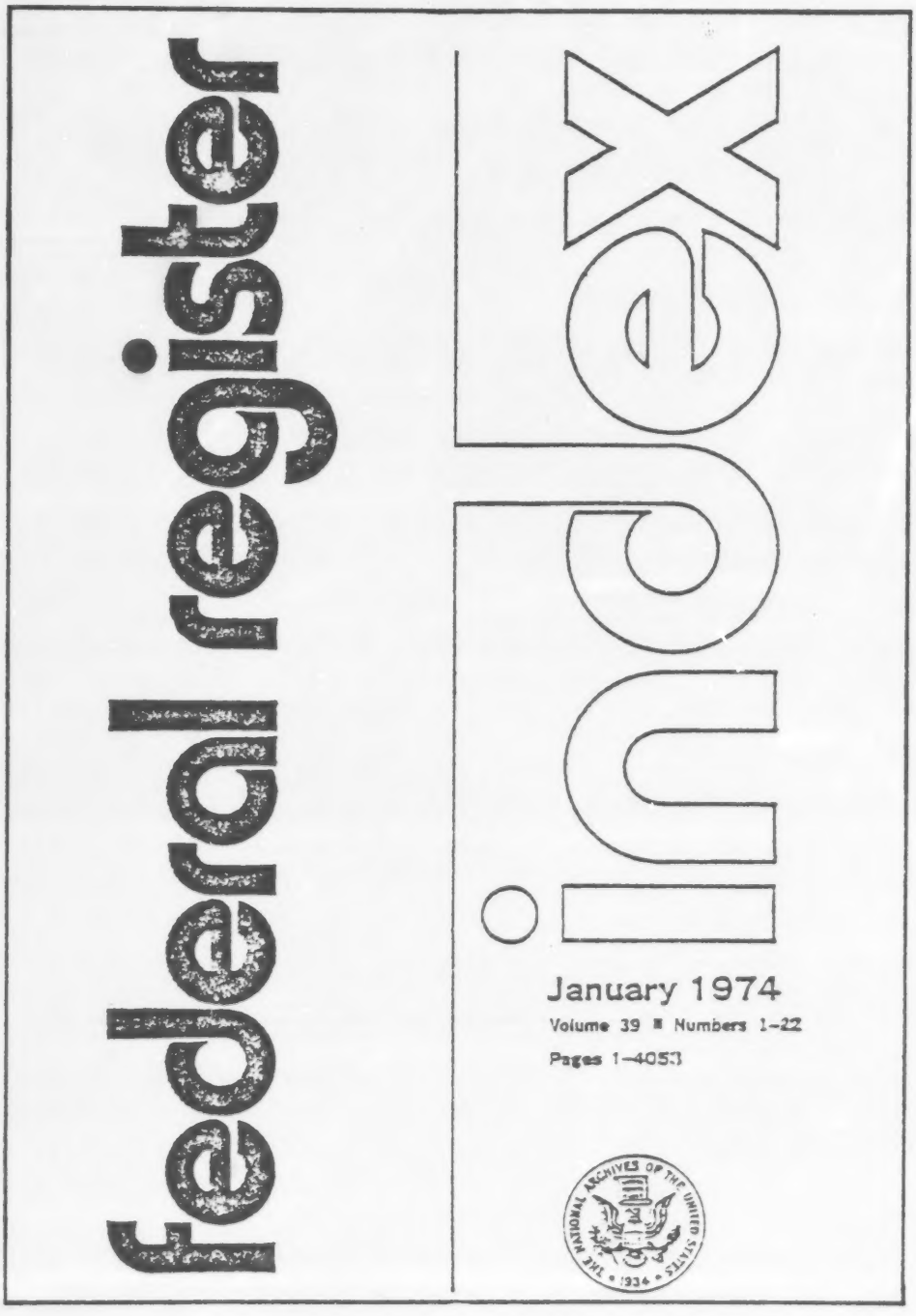
6. Products
7. Transportation
8. Occupational Health
9. Antitrust Review
10. General

Copies of published guides may be obtained by written request indicating the divisions desired to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director, Office of Standards Development.


code of federal regulations
List of CFR Sections Affected
JANUARY 1974
Includes U.S.C.–C.F.R. Table of Authorities
Announcing—
Format and Coverage Changes
Changes in coverage start with this List. These changes coordinate the List with the revision date of the Code books so that users can determine quickly and easily the changes that have occurred since the revision date of the Code books they are using. Coverage for January 1974 is as follows:
January 1974:
Titles 1–16: Changes published January 1974.
Titles 17–27: Changes published April 1973 through January 1974.
Titles 28–41: Changes published July 1973 through January 1974.
Titles 42–50: Changes published October 1973 through January 1974.
Note: Changes published during 1974 for Titles 17–50 are identified by an asterisk (*).


federal register
index
January 1974
Volume 39 ■ Numbers 1–22
Pages 1–4053
THE NATIONAL ARCHIVES OF THE UNITED STATES
1934

WASH 1283
Revision 1

Guidance on Quality Assurance Requirements During Design and Procurement Phase of Nuclear Power Plants - Revision 1

May 24, 1974

United States Atomic Energy Commission

GUIDANCE ON QUALITY ASSURANCE REQUIREMENTS DURING THE CONSTRUCTION PHASE OF NUCLEAR POWER PLANTS

May 10, 1974

UNITED STATES ATOMIC ENERGY COMMISSION

GUIDANCE ON QUALITY ASSURANCE REQUIREMENTS
DURING THE OPERATIONS PHASE OF
NUCLEAR POWER PLANTS

OCTOBER 26, 1973

Read each question carefully. Be sure to provide the specific information each question requires. Make your answers brief. Use the backs of the test if you need more space.

1. How was the Atomic Energy Commission established? What was its major purpose, with regard to the public? What were its main divisions?

2. When was the Nuclear Regulatory Commission established? What are its major functions?

3. What is the subject of Appendix B, Title 10, Code of Federal Regulations, Part 50?

4. Name the books in the Rainbow Series. Briefly describe the subject matter (content) of each book.

5. What is the purpose of a regulatory guide?

_____

_____

_____

_____

6. Name five areas covered in the Nuclear Regulatory Commission (NRC) Regulatory Guides.

a. _____

b. _____

c. _____

d. _____

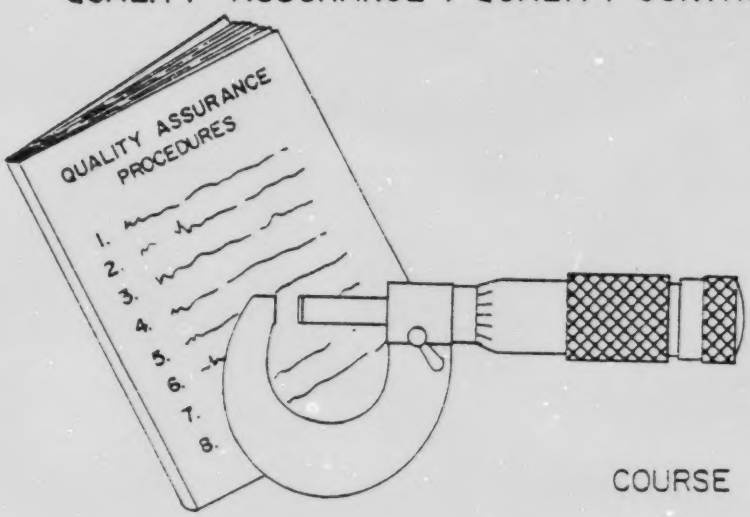
e. _____

7. How do regulatory guides affect quality-assurance/quality-control activities?

NUCLEAR TECHNOLOGY

MODULE 14-4 TECHNICAL REGULATION OF QUALITY ASSURANCE/ QUALITY CONTROL (ASME, ANSI)

INTRODUCTION TO
QUALITY ASSURANCE / QUALITY CONTROL



COURSE 14

COURSE MODULES

COURSE 14 INTRODUCTION TO QUALITY ASSURANCE/QUALITY CONTROL

MODULE 14-1	Basic Requirements for Quality Assurance/ Quality Control
MODULE 14-2	Definitions and Descriptions of Quality Assurance/Quality Control Criteria
MODULE 14-3	Governmental Regulation of Quality Assurance/ Quality Control (AEC, NRC)
MODULE 14-4	Technical Regulation of Quality Assurance/ Quality Control (ASME, ANSI)
MODULE 14-5	Implementation of Quality Assurance/Quality Control Programs and Procedures
MODULE 14-6	Application of Quality Assurance/Quality Control to Industry
MODULE 14-7	Techniques and Variations in Quality Assurance/ Quality Control
MODULE 14-8	Quality Assurance/Quality Control Records and Documents
MODULE 14-9	Special Studies in Quality Assurance/Quality Control

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INTRODUCTION

The American Society of Mechanical Engineers (ASME) and the American National Standards Institute (ANSI), founded in the last quarter of the nineteenth century, have grown into effective bodies, combining knowledge and expertise of scientists and engineers from around the world. Accomplishments of ASME include development and publication of the Boiler and Pressure Vessel Code, commonly known as the "Code." ANSI is recognized as a leading authority on industry standards.

Acceptance of the ASME Code and ANSI Standards by industry attracted the attention of governments (local, state, Federal and foreign) to the attributes of such documents, resulting in the adoption and endorsement of both the Code and Standards by many of these authorities.

MODULE PREREQUISITES

The student should have satisfactorily completed Module 14-1, "Basic Requirements for Quality Assurance/Quality Control in the Nuclear Industry," Module 14-2, "Definitions and Descriptions of Quality-Assurance/Quality-Control Criteria," and Module 14-3, "Governmental Regulation of Quality Assurance/Quality Control (AEC, NRC)."

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Explain the roles of technical societies in the nuclear industry.
2. Describe mandatory requirements of ASME Code, Section III, for quality assurance.
3. State how an authorized inspector certifies quality of a Code product.
4. Explain basic difference between ASME Code and ANSI Standards.
5. State how ANSI Standards might become mandatory on industry.
6. Give the names and briefly describe the functions of three technical societies (other than AWS and ANSI) affecting the nuclear industry.
7. Study an ANSI-N45.2 Standard; explain why requirements of such a standard are mandatory and must be complied with according to governmental regulations.

CODES AND ANSI STANDARDS

The American Society of Mechanical Engineers (ASME) was founded in 1880 as an educational and technical society of individual members. Its principal aims and objectives include:

- Developing and disseminating technical information to provide continuing education to mechanical engineers, the industries they serve and mankind in general.
- Developing industry's mechanical standards, codes, safety procedures and operating principles.
- Encouraging the personal and professional development of practicing and student engineers.
- Fostering engineering skills by means of an exchange of knowledge among peers.
- Maintaining a body of current engineering knowledge.
- Assisting in maintenance of a high level of ethical conduct.

The ASME, through voluntary participation of mechanical engineers and the industry at large, developed and published numerous codes and standards to guide industry in its progress and achievement of goals. The Boiler and Pressure Vessel Code, a world renowned document, was adopted in 1914.

This Code, the only comprehensive technical, scientific and engineering reference document on design, construction and operation of boilers and pressure vessels, received Federal, state and local government endorsements. Its pro-

visions protect public health and safety. This inherent feature made the role of ASME even more important as nuclear power evolved.

Like ASME, the American National Standards Institute (ANSI) developed standards to provide guidance for industry. In 1970, ANSI established a committee to study nuclear industry requirements, and prepared specific standards to serve that industry.

Adoption of the Code and ANSI Standards by governmental authorities has imbued the documents with a significant importance in the regulatory and licensing processes of nuclear power plants.

ASME CODE, SECTION III; ITS PROVISIONS ON QUALITY ASSURANCE AND QUALITY CONTROL

ASME established a committee, in 1911, to formulate standard rules for the design, fabrication, inspection and construction of steam boilers and pressure vessels. Objectives of these standards were to afford protection of life and property, as well as a safe margin for a long period of product usefulness.

Efforts of the committee resulted in publication of the Boiler and Pressure Vessel Code (1914). This ASME Code has been revised several times since its initial publication in 1914, to keep abreast of new materials development, technology advance, safety requirements and the state of the art.

Meanwhile, the Code has grown from a concise and modest document to a voluminous and elaborate encyclopedia of engi-

neering and technical data, essential to design and development. The 1974 edition contains eleven sections - each section governed by a committee of members elected (or designated) by the Council of the Society. Each section is divided into parts (divisions) dealing with specific aspects of a field of knowledge or technology:

Section I. Power Boilers.

Section II. Material Specifications.

Part A - Ferrous Metals.

Part B - Nonferrous Metals.

Part C - Welding Rods, Electrodes and Filler Metals.

Section III. Nuclear Power Plant Components.

Division 1.

Subsection NA - General Requirements.

Subsection NB - Class 1 Components.

Subsection NC - Class 2 Components.

Subsection ND - Class 3 Components.

Subsection NE - Class MC Components.

Subsection NF - Component Supports.

Subsection NG - Core Support Structures.

Division 2, Code for Concrete Vessels and Containments.

Subsection CA - General Requirements.

Subsection CB - Concrete Reactor Vessels.

Subsection CC - Concrete Containments.

Section IV. Heating Boilers.

Section V. Nondestructive Examination.

Section VI. Recommended Rules for Care and Operation of Heating Boilers.

Section VII. Recommended Rules for Care of Power Boilers.

Section VIII. Pressure Vessels.
Division 2, Alternative Rules.
Section IX. Welding and Brazing Qualifications.
Section X. Fiberglass-Reinforced Plastic Pressure Vessels.
Section XI. Rules for Inservice Inspection of Nuclear Power Plant Components.

Section III, designated as the "Nuclear Section," contains two divisions:

Division 1 - Nuclear Power Plant Components (Metals).
Division 2 - Nuclear Power Plant Components (Concrete Reactor Vessels and Containments).

This section of the Code is the most important single document for design, fabrication and construction of nuclear materials, components, subassemblies, appurtenances and vessels, including reactors and containments. Each division contains subsections divided into:

Articles.
Subarticles.
Paragraphs.
Subparagraphs.
Sub-subparagraphs.

Article NA-4000 of Division 1 and Article CA-4000 of Division 2 address quality-assurance requirements of Section III.

These QA requirements are mandatory for all work performed under the provisions of the Code. Like the Quality-Assurance Criteria (Appendix B, 10CFR50), articles NA-4000 and CA-4000 stipulate that applicants for certificates of authorization to use Code symbol stamps must establish quality-assurance programs for the control of items to be constructed

and activities to be performed. These quality-assurance programs define the organizational structures within which the programs are to be implemented. Also, they must clearly delineate responsibilities, levels of authority and lines of communication for various individuals, groups and subcontractors involved.

Each program must establish the necessary measures and procedures for dealing with the following:

Organization.
Design control.
Instructions, procedures and drawings.
Document control.
Handling, storage, shipping and preservation.
Control of purchased materials, items and services.
Welding and heat treating.
Fabrication of piping subassemblies.
Installation and erection.
Nondestructive examination.
Examinations, tests and inspections.
Examination of process status.
Nonconforming materials or items.
Control of measurement and test equipment.
Audits.
Corrective actions.
Records and data reports.

ASME requires that quality-assurance programs be reviewed and approved by their Society, by the appropriate inspection agency (that will perform the inspection) and by the local jurisdictional authority. Only then can an ASME Certificate of Authorization be issued. Upon acceptance

of a quality-assurance program, ASME requires that all activities involving Code rules and regulations be inspected by an authorized inspector, who must confirm that Code requirements and quality-assurance program plans are fully implemented. Through this action, ASME upholds the principles of the Code and ensures continuance of excellence of quality of items and activities carrying a Code symbol stamp.

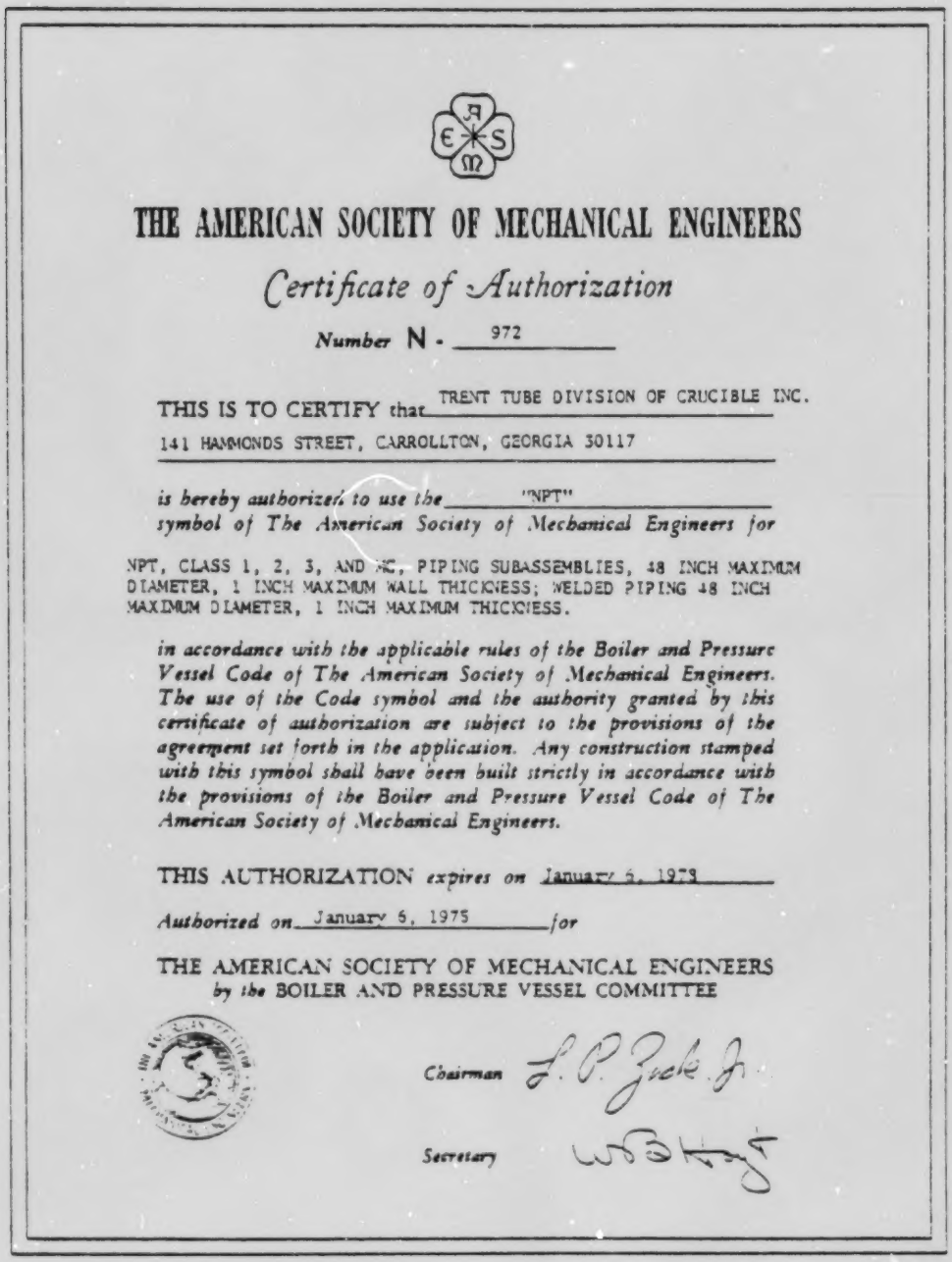
Section III of the Code, as well as other sections, declares that items and activities produced or performed in accordance with the provisions of the Code shall meet a standard of quality commensurate with the design, fabrication, construction and intended use of such items and activities. Because the Code is published as an engineering and technical document by the Society to serve industry and mankind, the responsibility for items and activities rests with the manufacturer or contractor.

Anyone using the Code for design, manufacture and construction of an item (or performance of an activity) must obtain authorization from the Society to do so. If, after review and evaluation, authorization is granted, a Certificate of Authorization (Figure 14-4-1) is issued for that specific application.

Everyone who has been issued a Certificate of Authorization must have a contract with a duly licensed (by a state) inspection agency. The agency inspects and verifies that all Code activities comply with the Code. Inspection agencies must employ competent inspectors, qualified and designated by a state to be "authorized inspectors."

Authorized inspectors must have full access, at all times, to all shops and field locations to inspect Code-related items, including:

Specifications and drawings.



THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Certificate of Authorization

Number N - 972

THIS IS TO CERTIFY that TRENT TUBE DIVISION OF CRUCIBLE INC.

141 HAMMONDS STREET, CARROLLTON, GEORGIA 30117

is hereby authorized to use the "NPT"
symbol of The American Society of Mechanical Engineers for

NPT, CLASS 1, 2, 3, AND MC, PIPING SUBASSEMBLIES, 48 INCH MAXIMUM DIAMETER, 1 INCH MAXIMUM WALL THICKNESS; WELDED PIPING 48 INCH MAXIMUM DIAMETER, 1 INCH MAXIMUM THICKNESS.

in accordance with the applicable rules of the Boiler and Pressure Vessel Code of The American Society of Mechanical Engineers. The use of the Code symbol and the authority granted by this certificate of authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the Boiler and Pressure Vessel Code of The American Society of Mechanical Engineers.

THIS AUTHORIZATION *expires on* January 6, 1979

Authorized on January 6, 1975 *for*

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
by the BOILER AND PRESSURE VESSEL COMMITTEE

Chairman L. P. Zick Jr.

Secretary W. E. Hay

Figure 14-4-1. Facsimile "Certificate of Authorization" from American Society of Mechanical Engineers.

Materials and components.
Procedures and instructions.
Installations and erections.
Tests and examinations.
Nonconformances and corrective actions.
Records and documents.

The "full-access" provision must be a condition of the inspection contract.

Code items and activities found by an authorized inspector to be in compliance with the Code must be identified by a Code symbol stamp witnessed by the authorized inspector. In addition, the inspector must co-sign (with holder of Certificate of Authorization) a Code Data Report, documenting full compliance with the Code.

From the preceding information, it becomes evident that ASME has the ability and enforcement authority to regulate industry by means of mutually agreed upon conditions between the Society and the users of the Code. In addition to such voluntary regulation between ASME and users of the Code, authorities such as NRC require that Code conditions be met by endorsement, or by reference in their licensing processes.

A review of the text of Articles NA-4000 and CA-4000 shows that the intent of Section III, on quality assurance, is very similar to that of the Eighteen Criteria discussed in Module 14-2.

ANSI STANDARDS N45.2; THEIR PROVISIONS FOR QUALITY ASSURANCE AND QUALITY CONTROL

The American National Standards Institute (ANSI) founded at about the same time as the ASME, strives to augment the efforts of other technical societies and organizations by preparing and publishing standards delineating methods, procedures and techniques for achieving full compliance with the Code and other requirements.

ANSI may be regarded as the industry's self-regulating entity. It is composed of committees acting in their areas of competence to provide industry with requirements and guidelines.

Because the design of a nuclear power plant requires close adherence to controlled quality-assurance procedures, as promulgated by NRC and ASME, industry has begun formal preparation of nuclear quality-assurance standards. During 1969 and 1970, ANSI assigned its Standards Committee (N45 "Reactor Plants and Their Maintenance") responsibility for establishing a subcommittee (N45.2 "Nuclear Quality-Assurance Standards") to coordinate and review industry efforts to prepare, develop and publish needed standards.

Each standard issued by the subcommittee has been subjected to an extremely intensive preparation and review process. It is believed that these standards contain precise statements of acceptable current practices for nuclear power plants, practices deemed necessary for achieving required levels of quality.

The ANSI Nuclear Quality-Assurance Standards are intended to be compatible with, and consistent with, the NRC quality-assurance criteria, as well as ASME Section III, NA-4000 and CA-4000 quality-assurance provisions. The NRC

and ASME Code are mandatory regulations, establishing firm requirements for the areas they cover; however, the N45.2 standards are not intended to be self-sufficient regulatory documents, but rather supplementary requirements and guidelines. Therefore, it is important to note that the standards use such verbs as "shall," "should" and "may" as follows:

"Shall" means the requirements must be followed to comply with the standard (mandatory).

"Should" means the guidelines that must be followed to be consistent with the standard (recommended).

"May" means acceptable or equivalent practices must be followed.

Also, it should be emphasized that careful and comprehensive reading of the standards is required. Because the standards project a consensus of the industries they serve, it is often necessary that certain sections be read and interpreted as a single unit and not implied or interpreted sentence by sentence.

The N45.2 subcommittee continues to consider nuclear standards for the industry. The complexity of the task and subject matter (nuclear quality assurance) makes the job difficult and time consuming. Several standards have been issued to date, and many more are in preparation.

Standards available include:

N45.2-1971: Quality-Assurance Requirements for Nuclear Power Plants.

N45.2.1-1973: Cleaning of Fluid Systems and Associated Components During the Construction Phase of Nuclear Power Plants.

N45.2.2-1973: Packaging, Shipping, Receiving, Stor-

age and Handling of Items for Nuclear Power Plants (during construction phase).

N45.2.3-1973: Housekeeping During Construction Phase of Nuclear Power Plants.

N45.2.4-1972: Supplementary Quality-Assurance Requirements for Installation, Inspection and Testing of Instrumentation and Electric Equipment During Construction of Nuclear Power Generating Stations.

N45.2.5: Supplementary Quality-Assurance Requirements for Installation, Inspection and Testing of Structural Concrete and Structural Steel During Construction Phase of Nuclear Power Plants.

N45.2.6-1973: Qualifications of Inspection, Examination and Testing Personnel for Construction Phase of Nuclear Power Plants.

N45.2.8: Supplementary Quality-Assurance Requirements for Installation, Inspection and Testing of Mechanical Equipment and Piping for Construction Phase of Nuclear Power Plants.

N45.2.9: Requirements for Collection, Storage and Maintenance of Quality-Assurance Records.

N45.2.10-1973: Quality-Assurance Terms and Definitions.

N45.2.11: Quality-Assurance Requirements for Design of Nuclear Power Plants.

N45.2.12: Requirements for Auditing of Quality-Assurance Programs for Nuclear Power Plants.

N45.2.13: Supplementary Quality-Assurance Requremeents for Control of Procurement for Equipment, Materials and Servites for Nuclear Power Plants.

N45.2.14: Supplementary Quality Assurance Requirements During Design and Manufacture of Class IE Instrumentation and Electric Equipment for Nuclear Power Generating Stations.

N45.2.15: Requirements for Control of Hoisting, Rigging and Transporting of Items at Nuclear Power Plant Sites.

N45.2.16: Supplementary Quality-Assurance Requirements for Calibration and Control of Measuring and Test Equipment Used at Nuclear Power Generating Stations.

N45.2.17: Quality-Assurance Requirements for Control of Welding Process for Nuclear Power Plants.

As demonstrated in Module 14-3, "Governmental Regulation of Quality Assurance/Quality Control (AEC, NRC)," several of the ANSI N45.2 standards have been endorsed by NRC in its published "rainbow" series and Regulatory Guides. These endorsed standards become mandatory requirements and applicants for nuclear licenses must comply with them. Deviations and modifications in complying with any provision of an endorsed standard must be approved by NRC.

The ASME Quality-Assurance requirements, Section III, are consistent with NRC's Eighteen Criteria as far as those responsibilities are concerned. The ANSI Standards, however, are not specific in their requirements and recommendations. Nevertheless, the intent of the ANSI Standards is consistent and must be recognized as such.

Table 14-4-1, "Cross Reference of Quality-Assurance Requirements, NRC-ASME-ANSI," demonstrates that government (NRC), technical societies (ASME) and industry representatives (ANSI) share the same goals and standards. It is important to realize that the effort in duplication among

TABLE 14-4-1

CROSS REFERENCE OF QUALITY-ASSURANCE REQUIREMENTS

NRC - ASME - ANSI

NRC Criteria 10 CFR50 Appendix B	ASME Sect. III Requirements		ANSI Standards N-45
	Division 1	Division 2	
I	NA-4200	CA-4130	N45.2, N45.2.6
II	NA-4140	CA-4220	N45.2, N45.2.6
III	NA-4410	CA-4300	N45.2.11
IV	NA-4440	CA-4400	N45.2.13
V	NA-4420	CA-4420	N45.2
VI	NA-4450	CA-4430	N45.2.9
VII	NA-4440	CA-4400	N45.2.13
VIII	NA-4442	CA-4450	N45.2.2
IX	NA-4451	CA-4460	N45.2.1, .15, .17
X	NA-4510	CA-4510	N45.2.4, .5, .8
XI	NA-4500	CA-4520	N45.2.4, .5, .8
XII	NA-4600	CA-4530	N45.2.16
XIII	NA-4460	CA-4600	N45.2.2, .3, .15
XIV	NA-4452	CA-4700	N45.2.4
XV	NA-4550	CA-4720	N45.2.2
XVI	NA-4800	CA-4730	N45.2.4
XVII	NA-4900	CA-4800	N45.2.9
XVIII	NA-4700	CA-4900	N45.2.23

these requirements exceeds by far the risk of leaving anything unspecified.

OTHER TECHNICAL SOCIETIES AND THEIR RELATIONSHIPS TO QUALITY ASSURANCE/QUALITY CONTROL

In addition to ASME and ANSI, there are several other technical societies that contribute greatly to the nuclear industry and to its quality-assurance and quality-control efforts. The participation and involvement of such other societies are dependent on their area of expertise and their inter-relationships with one another.

THE AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

The ASTM serves the nuclear industry by testing and evaluating existing and new materials for use in nuclear applications. The results of such efforts are published in a standard specification available to industry and the public.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

Since nuclear power plants utilize a great deal of electrical and electronic circuitry and controls in the production and distribution of electrical energy, the IEEE is deeply involved in the preparation and publication of standards and procedures for systems design and manufacturing.

In 1969, the IEEE, in joint committee with the Nuclear Power Standards Committee, started to prepare a standard to guide the nuclear industry during the construction of nuclear power plant systems. In 1970, the ANSI N45.2 subcommittee on Nuclear Quality Assurance requested that IEEE consider the ANSI requirements for nuclear installation

and make the IEEE standard in preparation a joint one. As a result of this action, the standard for "Installation, Inspection and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Stations" was completed.

This and many similar joint efforts by technical societies make it possible for the nuclear industry to receive and benefit from the best expertise possible.

AMERICAN CONCRETE INSTITUTE (ACI)

The American Concrete Institute agreed to sponsor a joint technical committee with ASME to provide the industry with guidance on concrete pressure components for nuclear service. At the time of such agreement, both ACI and ASME had their own documents in preparation. The agreement, however, made it possible for ACI to combine the work of its Committee 349 on "Criteria for Nuclear Containment Vessels" with ASME Code committee work on "Subgroup on Concrete Components." The results of this joint effort were proposed in 1972 and published in 1973 as "ASME, Section III, Division 2, Code for Concrete Reactor Vessels and Containments."

AMERICAN WELDING SOCIETY (AWS)

The AWS, in cooperation with ASME, standardized the classification of welding rods, welding electrodes, welding fluxes and other welding supplies. These classifications made possible uniform specifications with clearly defined requirements and guidelines. It is, therefore, possible for users to procure and use weld filler metal products without risk as to acceptability of origin, physical and chemical properties and appropriate documentation.

It is important to note that the above mentioned societies are but some of those involved with industry in general and the nuclear community in particular. The student should become familiar with other organizations and their contributions to industry.

EXERCISES

None.

MATERIALS

None.

PROCEDURES

1. Review the contents of Module 14-1, "Basic Requirements for Quality Assurance-Quality Control in the Nuclear Industry," together with this module; prepare a summary explaining the roles of technical societies in the nu-

clear industry; list the prominent societies mentioned in these modules and briefly state whether their roles impose mandatory or voluntary requirements on industry.

2. Obtain a copy of ASME Code Section III, Divisions 1 and 2; study the contents of Articles NA-4000 and CA-4000 on quality assurance; list the mandatory requirements of the aforementioned articles; explain why such requirements are mandatory; state by whose authority these requirements are made mandatory.

3. Use Code Section III, Divisions 1 and 2; refer to Articles NA-5000 and CA-5000, "Inspection;" prepare a summary of the qualifications and duties of an authorized inspector; also explain the following:

   Who is eligible to become an authorized inspector?

   How does an authorized inspector certify that a product or activity complies with the rules of the Code?

   Are authorized inspectors qualified to inspect work done under Section III, Division 1? Section III, Division 2? Both? Why?

4. Obtain a copy of ANSI Standard N45.2, "Quality-Assurance Program Requirements for Nuclear Power Plants;" study the "Foreword" of this standard; also, study the "Foreword" of Code Section III; explain basic differences between the ASME Code and the ANSI Standards. Why is the ASME Code mandatory?

5. This module explains how technical societies work with and contribute to industry by establishing standards and providing technical guidance; however, it does not identify all such societies. Use Section III of the Code and other reference documents; name technical

societies, not mentioned in this module, that affect the nuclear industry; state how they affect the industry. (See article on codes, standards and specifications referenced in the text of Section III, Division 2.)

DATA TABLE

None.

REFERENCE MATERIALS

American Society of Mechanical Engineers. "Nuclear Power Plant Components, Subsection NA, General Requirements." ASME Boiler and Pressure Vessel Code, Section III, Division 1. New York: ASME, 1974.

_____. "Nuclear Power Plant Components, Code for Concrete Reactor Vessels and Containments." ASME Boiler and Pressure Vessel Code, Section III, Division 2. New York: ASME, 1975.

_____. "Quality Assurance Requirements for Nuclear Power Plants," ANSI N45.2-1971. American National Standard, Reactor Plants and Their Maintenance. New York: ASME, 1971.

American Society of Quality Control. "Matrix of Quality Assurance Requirements." Milwaukee, WI: American Society of Quality Control.

U.S. Atomic Energy Commission. "Quality Assurance Criteria for Nuclear Power Plants." Code of Federal Regulations, Title 10 - Atomic Energy. In the Federal Register, No. 125, 35 (June 1970).

The following professional organizations carry additional information on QA/QC technical regulations:

American Concrete Institute
Box 19150, Redford Station
Detroit, Michigan 48219

American Society for Testing Materials
1916 Race Street
Philadelphia, Pennsylvania 19103

American Welding Society
2501 N.W. 7th Street
Miami, Florida 33125

Institute of Electrical and Electronics Engineers
345 E. 47th Street
New York, New York 10017

Read each question carefully. Be sure to provide the specific information each question requires. Make your answers brief. Use the backs of the test if you need more space.

1. List three principal aims of the American Society of Mechanical Engineers (ASME).

   a. _____

   _____

   b. _____

   _____

   c. _____

   _____

2. Briefly describe the subject matter of Section III of The Boiler and Pressure Vessel Code developed by ASME.

   _____

   _____

   _____

   _____

3. The Boiler and Pressure Vessel Code requires the establishment of quality control programs and activities in the nuclear industry. List ten (10) areas in which quality assurance programs must establish measures and procedures.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

3. f. _____

g. _____

h. _____

i. _____

j. _____

4. Briefly describe the role of the "authorized inspector" in certifying the quality of a code product.

_____

_____

_____

_____

_____

_____

_____

_____

_____

5. Briefly explain the basic difference between the ASME Code and the American National Standards Institute (ANSI) Standards.

_____

_____

_____

_____

_____

6. How do ANSI Standards become mandatory on the nuclear industry?

_____

_____

7. State the names and briefly describe the functions of three technical societies <u>besides</u> ASME and ANSI, that affect the nuclear industry.

a. _____

_____

_____

_____

b. _____

_____

_____

_____

c. _____

_____

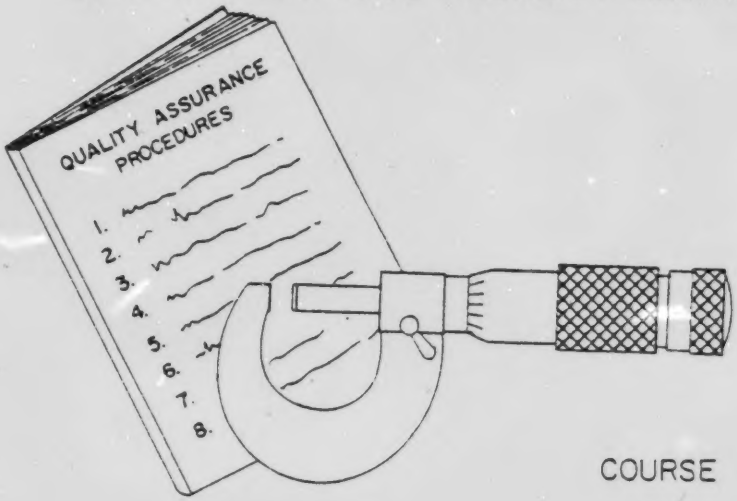
_____

_____

NUCLEAR TECHNOLOGY

MODULE 14-5 IMPLEMENTATION OF QUALITY-ASSURANCE/QUALITY CONTROL PROGRAMS AND PROCEDURES

INTRODUCTION TO QUALITY ASSURANCE / QUALITY CONTROL



COURSE 14

COURSE MODULES

COURSE 14 INTRODUCTION TO QUALITY ASSURANCE/QUALITY CONTROL

MODULE 14-1	Basic Requirements for Quality Assurance Assurance/Quality Control
MODULE 14-2	Definitions and Descriptions of Quality-Assurance/Quality-Control Criteria
MODULE 14-3	Governmental Regulation of Quality Assurance/Quality Control (AEC, NRC)
MODULE 14-4	Technical Regulation of Quality Assurance/ Quality Control (ASME, ANSI)
MODULE 14-5	Implementation of Quality-Assurance/Quality-Control Programs and Procedures
MODULE 14-6	Application of Quality Assurance/Quality Control to Industry
MODULE 14-7	Techniques and Variations in Quality Assurance/Quality Control
MODULE 14-8	Quality-Assurance/Quality-Control Records and Documents
MODULE 14-9	Special Studies in Quality Assurance/Quality Control

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INTRODUCTION

A quality-assurance program is a requirement of government regulations, the Code and other authorities; therefore, it must be devised with a specific purpose and must accomplish definitive results. Regardless of the size of an organization, its quality-assurance program must contain the basic elements that ensure its effectiveness.

MODULE PREREQUISITES

The student shall have completed all previous modules in this Course.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Name and describe the essential elements of a typical quality-assurance program.
2. Explain the objectives of quality-assurance/quality-control manuals.
3. Identify the purposes of quality-assurance/quality-control procedures.

4. Explain the relationships between quality-assurance/quality-control manuals and procedures.
5. Determine the functions of quality-assurance/quality-control personnel in implementing control procedures.
6. Define the responsibilities of production personnel toward quality-assurance/quality-control.
7. Make a class presentation emphasizing the cooperation between production and quality-assurance/quality-control personnel in producing quality products meeting all specified requirements.

A quality-assurance program should have as a minimum:

Precise objectives for reaching specific and predetermined results.

Long-range plans and schedules for accomplishing its objectives.

Support and participation of top management.

Written manual or manuals delineating its scope and purpose.

Procedures responsive to needs of personnel whose activities it describes.

Properly trained and qualified personnel to implement its objectives.

Provisions for training and indoctrinating personnel whose functions and performances it involves.

Measures to evaluate its effectiveness and status.

Essential requirements of compliance with regulatory authorities it serves.

Provisions for future changes and modifications required to keep it current.

Corporate quality-assurance policies must be written documents, clearly stating a commitment by the organization to meet specific quality-assurance requirements. Policy documents must be combined into a manual, providing reference, guidance and direction to those responsible for ensuring compliance with its provisions; therefore, the quality-assurance program must be responsive to:

Corporate quality-assurance policies.

NRC, Appendix B, 10CFR50.

NRC Regulatory Guides.

ASME Section III, Divisions 1 and 2.
ANSI N45.2 Standards.
ASME Section V.
ASME Section XI.
Other special or unique requirements.

QUALITY-ASSURANCE/QUALITY-CONTROL MANUAL

The quality-assurance/quality-control manual is a corporate document containing corporate policies stating commitments of the organization to specific quality-assurance requirements. The diversity of the nuclear industry makes it difficult to standardize the form or format of such manuals, therefore, the document is unique for each organization, but carefully prepared to fulfill specific functions.

The Manual must include, therefore, all necessary information to describe the quality-assurance program, with clarity and explicitness. It should be a formal document bearing a title and the name of the organization. And, as a minimum, it should contain the following parts or elements.

FOREWORD

The foreword states the purpose of the manual and briefly describes the corporate objectives of the quality-assurance program.

MANUAL REVISION STATUS

Manual revisions are logged on a specially devised form.

STATEMENT OF POLICY

A statement of policy, made by a corporate official (chairman of the board, president or vice president of operations)indicates that the corporate management authorizes the quality-assurance program and supports its provisions.

AUTHORITY AND RESPONSIBILITY

Authority and responsibility, including quality-assurance/quality-control staff, are described. Each staff member is identified by position and function.

ORGANIZATION

Organization is the most important element of a quality-assurance program. The manual provides a narrative as well as pictorial description of organizational structure, including the executive management ultimately responsible for quality assurance. Also included are production management and production staff supervision. The organizational chart shows lines of responsibilities, lines of communication and lines of information. The organization clearly indicates that the quality-assurance director, manager, or top staff officer has a direct line of responsibility to corporate management but is independent of production man-

agement or staff.

OTHER ELEMENTS

The quality-assurance manual may vary considerably from one organization to another. The manual of a nuclear facility must include:

- Design basis of facility.
- Procurement policies for material and equipment.
- Procurement policies for services and contracts.
- Training and indoctrination of personnel.
- Correspondence and transactions with NRC.
- Document control.
- Audits.

A contractor's quality-assurance manual must include:

- Control of drawings and specifications.
- Control of purchased materials and equipment.
- Control of receiving, inspecting and warehousing of materials and equipment.
- Control of special processes of welding and nondestructive testing.
- Control of documents.
- Control of measuring and test equipment.
- Control of nonconforming materials.
- Control of inspection and tests.
- Control of audits.

Volume I of a quality-assurance manual contains corporate quality-assurance policies responsive to the Nuclear Regulatory Commission's requirements of 10CFR50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants."

Volume II contains corporate quality-assurance policies responsive to the requirements of Section III of the ASME

Boiler and Pressure Vessel Code. (Book 1 of Volume II is composed of elements responsive to the topics of Article NA-4000 of Section III, Division 1, "Nuclear Power Plant Components." Book 2 of Volume II is composed of elements responsive to the topics of Article CA-4000 of Section III, Division 2, "Concrete Reactor Vessels and Containments."

Volume III contains corporate quality-assurance policies responsive to requirements of Section V of the ASME Boiler and Pressure Vessel Code, nondestructive examinations.

Volume IV contains corporate quality-assurance guides responsive to quality-assurance policies contained in Volumes I, II and III. They delineate methods, instructions and details for making smooth and uniform transitions from concise quality-assurance policies to detailed and comprehensive quality-assurance procedures and instructions.

The quality-assurance manual does not have to be structured in volumes or texts. The important aspects of the manual are its responsiveness to requirements, and its applicability.

QUALITY-ASSURANCE/QUALITY-CONTROL PROCEDURES AND INSTRUCTIONS

Quality-assurance/quality-control procedures and instructions (documents) constitute the working tools for implementing and executing a quality-assurance program. These documents must be contained in and made a part of the quality-assurance manual.

Although forms and formats of quality-assurance documents may vary widely from one organization to another, each document should have all, or as many as possible, of the following items:

NUMBER AND TITLE

The number and title should be concise, descriptive and specific in identifying the subject matter addressed.

PURPOSE

The specific requirements to be established should be clearly stated.

SCOPE

The basic functions or activities to be controlled should be listed.

REFERENCES

Documents that interface with the guide, procedure or instruction should be referenced.

DEFINITIONS

Definitions include descriptions of new and relevant terms directly affecting the subject guide, procedure or instruction, in whole or in part.

RESPONSIBILITY

The responsibility of each person or organization affecting the implementation, in whole or in part, should be clearly defined.

PROCEDURE

The procedure section outlines and describes how the guide, procedure or instruction is to be implemented and controlled.

DOCUMENTATION

Requirements for control of documents prepared or generated by the guide, procedure or instruction should be stated to permit document control to receive, classify and identify them.

AUDITS

Proper implementation of the guide, procedure, instruction (including audit reports, distribution and follow-up audits) should be verified in accordance with provisions delineated in the quality-assurance manual.

FOLLOW-UP AND REVIEW

Follow-up and review should include specific actions required and specific responsibilities for verifying, evaluating and validating resultant information or documentation.

A sample corporate quality-assurance guide is included as an Appendix to this module. Also included is a comprehensive quality-control procedure, which demonstrates the complexity and thoroughness of a well prepared procedure.

QUALITY-ASSURANCE/QUALITY-CONTROL PERSONNEL: THEIR FUNCTIONS

The quality-assurance organization was acclaimed earlier as the most important element of a quality-assurance program. If so, corporate management must exercise extreme care and demonstrate sound judgment in selecting and assigning quality-assurance/quality-control personnel. Regardless of organizational structure, lines of hierarchy, quality-assurance/quality-control personnel must meet special requirements and perform special functions consistent with their duties and responsibilities (as delineated in the quality-assurance manual).

Module 14-2, "Definitions and Descriptions of Quality-Assurance/Quality-Control Criteria," includes several types of organizational charts as well as narrative descriptions of quality-assurance/quality-control personnel titles, duties and responsibilities. Review of these descriptions indicates that quality-assurance/quality-control personnel are trained individuals responsible for performing vital functions in their organization.

EXERCISES

None.

MATERIALS

None.

PROCEDURES

1. Review contents of Module 14-2, "Definitions and Descriptions of Qaulity-Assurance/Quality-Control Criteria;" prepare an organizational chart showing a quality-assurance organization for an industry chosen by student; include appropriate personnel positions for type of industry selected.
2. Use organizational charts prepared in 1 (above); outline a quality-assurance program to serve the goals of the organization.

DATA TABLE

None.

REFERENCE MATERIALS

Technical Education Research Center Center-SW, ed. "Basic Requirements for Quality Assurance/Quality Control." Nuclear Technology Series developed pursuant to USOE Contract 300760356.

Technical Education Research Center-SW, ed. "Definitions and Descriptions of Quality-Assurance/Quality-Control Criteria." Nuclear Technology Series developed pursuant to USOE Contract 300760356.

Copies are available through U.S. Department of Health, Education and Welfare, Office of Education, Occupational and Adult Education Branch, 7th and D Sts., Washington, DC 20202.

A P P E N D I X

Courtesy of
H. B. Zachry Company,
San Antonio, Texas

QUALITY ASSURANCE MANUAL

VOLUME I

NUCLEAR POWER DEPARTMENT

INDUSTRIAL DIVISION

H.B. ZACHRY COMPANY

SAN ANTONIO, TEXAS

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H. B. ZACHRY COMPANY QUALITY ASSURANCE		FORM QA- 1000
– TITLE –		SER. No. 001
MANUAL REVISION STATUS		DATE 12-16-75

QUALITY CONTROL MANUAL

REVISION STATUS

Original Issue Date 3-1-75

Revision Number	Effective Date	Procedure Number	Page No	Remarks
A	12-16-75	All but IV, VIII, X, XI, XIV, XV, XXI	As noted by "A"	Scope of Manual revised to include fabrication of pressure vessels

F O R E W O R D

The H. B. Zachry Company has prepared this Quality Assurance Document to govern the Company's activities during the construction phase of nuclear power plants as required by Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants", to 10CFR Part 50, and the A.S.M.E. Code, Section III, "Nuclear Power Plant Components".

It is the purpose of this Document to establish corporate Quality Assurance Policies, Guides, and Procedures to meet the requirements for construction of safety-related structures, systems, and components of nuclear power plants.

Submitted by: M. A. Fahel
M. A. Fahel, Director
Quality Assurance

Approved by: C B Morris
C. B. Morris, Senior
Vice President and
General Manager

Approved by: H B Zachry
H. B. Zachry, Jr.
President

ZACHRY

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ZACHRY

H. B. ZACHRY COMPANY
General Contractors

H. B. Zachry, Jr.
President

December 16, 1975

STATEMENT OF POLICY

The H. B. Zachry Company, at my instruction, has established a Quality Control System responsive to the requirements of Section I and Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code.

The Quality Control System shall be implemented on materials, systems, components, or services which have been designed and are to be fabricated, constructed or installed in accordance with the rules of the applicable sections of the ASME Boiler and Pressure Vessel Code. The Quality Control System shall be described in a Quality Control Manual.

The authority for the administration and implementation of this Quality Control System is assigned by me to the Director, Quality Assurance.

I believe the System is important, and it has my full support.

H. B. ZACHRY COMPANY

H. B. Zachry, Jr.
President

Post Office Box 21130 · San Antonio, Texas 78285 · 512/922-1313 · Cable Address ZACO

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Form QAF-4, "TITLE PAGE"

PAGE NO. 1 OF 5 THIS PAGE HAS BEEN ☐ REVISED ☒ UNREVISED	H. B. ZACHRY COMPANY INDUSTRIAL DIVISION NUCLEAR POWER DEPARTMENT QUALITY ASSURANCE QUALITY ASSURANCE MANUAL VOLUME I U.S.A.E.C. "EIGHTEEN CRITERIA"	INITIAL EFFECTIVE DATE OF DOCUMENT July 15, 1975 EFFECTIVE DATE OF THE REVISION TO THIS PAGE

QA POLICY NUMBER X

- DOCUMENT NUMBER -

INSPECTION

- DOCUMENT TITLE -

APPROVED: C B Morris
C. B. Morris, Sr. Vice Pres. and Gen. Mgr.

APPROVED: _____

APPROVED: _____

APPROVED: _____

CONCURRENCE: M. A. Fahel
M. A. Fahel, Director, Quality Assurance

CONCURRENCE: _____

ACKNOWLEDGEMENT: A. L. Emerson
A. L. Emerson, Vice President, Construction

ACKNOWLEDGEMENT: _____

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REVISION STATUS LOG

DOCUMENT REVISION NUMBER	PAGE(S) AFFECTED	REVISION EFFECTIVE DATE	REVISION ISSUED BY	NATURE OF REVISION

Form QAF-7, "TEXT PAGE"

PAGE NO. 3 OF 5 THIS PAGE HAS BEEN ☐ REVISED ☒ UNREVISED	- DOCUMENT NUMBER - POLICY NUMBER X - DOCUMENT TITLE - INSPECTION	EFFECTIVE DATE OF THE REVISION TO THIS PAGE

1. PURPOSE:

   This Policy of H. B. Zachry Company's Quality Assurance Program shall establish measures prescribed in Quality Assurance Guides which will assure that all Inspections required to verify conformance to Design Drawings and Specifications are planned, executed and documented.

2. SCOPE:

   Quality Assurance Guides shall establish requirements that will be delineated in Quality Assurance Procedures and Work Instructions in order to assure that Inspections are performed by qualified personnel who are independent from the group being inspected and that Inspections are performed for each work activity as necessary to verify prescribed Quality.

3. DEFINITIONS:

   INSPECTION: Inspection is a phase of Quality Control which by means of examination, observation or measurement determines the conformance of material, supplies, components, parts, appurtenances, systems, processes or structures to predetermine Quality requirements.

   QC INSPECTOR: QC Inspector is a qualified inspector employed by the Constructor whose duties include the verification of quality related activities or installation or both.

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4. PROCEDURE:

The Quality Assurance Department shall be responsible for developing and implementing the H. B. Zachry Company Quality Assurance Program to assure compliance with the following measures:

- Inspection or tests required to verify conformance to Design Drawings and Specifications, Quality Assurance Procedures and Work Instructions, are planned, executed and documented.
- Inspections or tests are performed by qualified Quality Control Inspectors who are independent from the group performing the activity being inspected.
- Inspection or tests are performed for each work activity as necessary to verify prescribed Quality.
- Alternate controls are used by monitoring of manufacturing or test methods, equipment and personnel when direct inspection of materials or products is impossible or disadvantageous.
- Both inspection and process monitoring are provided when control is inadequate using only one method.
- Quality Assurance Inspection Procedures and Work Instructions are made available with necessary Design Drawings and Specifications for use prior to performing the planned Quality Control Inspection.
- The qualifications or certification of Quality Control Inspectors are maintained up-to-date.

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- Inspection of replacement or reworked items are in accordance with original inspection requirements.

- Inspection of modified or repaired items are by a method which is equivalent to the original inspection method.

- Appropriate documents identify mandatory inspection hold points which require witnessing or inspecting by a qualified Quality Control Inspector and beyond which no work shall proceed without the consent of the Quality Control Inspector.

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Form QAF-4, "TITLE PAGE"

PAGE NO. 1 OF 9 THIS PAGE HAS BEEN ☐ REVISED ☒ UNREVISED	H. B. ZACHRY COMPANY INDUSTRIAL DIVISION NUCLEAR POWER DEPARTMENT QUALITY ASSURANCE QUALITY ASSURANCE MANUAL VOLUME IV QUALITY ASSURANCE GUIDES	INITIAL EFFECTIVE DATE OF DOCUMENT July 15, 1975 EFFECTIVE DATE OF THE REVISION TO THIS PAGE

QA GUIDE NUMBER QAG-7
- DOCUMENT NUMBER -

INTERFACES WITH OTHER PERSONS OR ORGANIZATIONS
- DOCUMENT TITLE -

APPROVED: M. A. Fahel
H. A. Fahel, Director, Quality Assurance

APPROVED: _____

APPROVED: _____

APPROVED: _____

CONCURRENCE: A. L. Emerson
A. L. Emerson, Vice President, Construction

CONCURRENCE: _____

ACKNOWLEDGEMENT: _____

ACKNOWLEDGEMENT: _____

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DOCUMENT REVISION NUMBER	PAGE(S) AFFECTED	REVISION EFFECTIVE DATE	REVISION ISSUED BY	NATURE OF REVISION

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1. PURPOSE:

The purpose of this Guide is to establish requirements for the documentation of interfaces between individuals and organizations during the pre-construction, construction, and post construction phases of a nuclear facility.

2. SCOPE:

The scope of this Guide includes:

2.1 Interfaces with the Major Contractors and the Owner.

2.2 Interfaces with the Architect/Engineer.

2.3 Interfaces with Vendors and Suppliers.

3. REFERENCES:

H. B. Zachry QA Guide No. QAG-8, "Issuance, Receipt, and Processing of Correspondence".

H. B. Zachry QA Guide No. QAG-11, "The Materials Review Board".

H. B. Zachry QA Guide No. QAG-13, "Vendor or Supplier Evaluation".

4. DEFINITIONS:

OWNER: The Owner is the organization, or group of organizations, responsible for the overall financing and control of the nuclear project.

MAJOR CONTRACTORS: A Major Contractor is an organization holding a contract with the Owner for the design, fabrication, or construction of a nuclear facility.

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DESIGN BASES:	Design Bases shall mean the fundamental concepts of a structure, system, component, or entire facility, and the particular Drawings, Specifications, Procedures, and Work Instructions into which those concepts are translated.
DESIGN INTERFACE:	Design Interface shall mean the orderly and proper marriage between two or more Design Bases when design of structures, systems, components, or an entire facility has been so segmented.
DESIGN CHANGE:	Design Change shall mean modification in a previously issued Drawing, Specification, Procedure or Work Instruction, made by the original design organization, which renders that previous issue obsolete.
FIELD DESIGN CHANGES:	Field Design Changes shall mean a change resulting from a field condition or nonconformity, which may be requested by the contractor or subcontractor, but must be approved by the original design organization.

5. RESPONSIBILITY:

The Director, Quality Assurance is responsible for assuring that there is a clear delineation of interface between the Owner, Major Contractors, vendors or suppliers, as they relate to H. B. Zachry Company.

6. PROCEDURE:

6.1 INTERFACING WITH THE MAJOR CONTRACTORS AND THE OWNER:

Points of interface between the Owner, Major Contractors, and H. B. Zachry Company, as they relate

to Quality Assurance, shall be clearly defined in project unique QA Procedures and Work Instructions.

Project interface requirements, which effect Quality and result from the need for consultation, or cooperation with the Owner or Major Contractors, shall be delineated in the respective project unique QA Procedures and/or Work Instructions.

Interfaces resulting from contractual or Quality requirements to forward subcontractor documents, schedule changes, or the like to the Owner, shall be defined and provided for in QA Procedures.

Correspondence between the Owner, Major Contractors, and H. B. Zachry Company shall be conducted in accordance with requirements of H. B. Zachry QA Guide No. QAG-8, "Issuance, Receipt, and Processing of Correspondence", and project unique QA Procedures which identify recipients of correspondence.

6.2 INTERFACING WITH THE ARCHITECT/ENGINEER:

Requirements for interfacing with the Architect/Engineer shall be divided into two specific cases. Case I shall apply whenever H. B. Zachry Company has no responsibility for design, and Case II shall apply whenever H. B. Zachry Company holds a contract for the design of a nuclear facility.

6.2.1 CASE I:

The interface requirements for handling and reporting nonconformities necessitating a design change shall be specified by QA Procedures. Reports of nonconformities resulting in the need for a design change shall be submitted to the original design Engineer for solution by the Quality Assurance Manager at the project site. Approved solutions shall be returned to the Quality Assurance Manager for implementation.

Form QAF-7, "TEXT PAGE"

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QA Procedures shall specify H. B. Zachry Company's scope for the handling of Field Design Change reports resulting from a field condition. The Quality Assurance Manager at the project site shall be responsible for submitting Field Design Change reports to the original designer, who shall have sole responsibility for making the Design Change, and approving it. Approved Design Changes resulting from a Field Design Change report shall be returned to the Quality Assurance Manager.

QA Procedures and Work Instructions shall make provisions for the preparation, handling, and submittal of requests for Design Changes resulting from changes in regulations, limits in the "state of the art", or other condition which prevents construction in accordance with existing drawings and specifications. Such requests shall be reviewed by the Quality Assurance Manager, and submitted by him to the original design organization for action. Approved Design Changes resulting from such requests shall be returned to the Quality Assurance Manager.

QA Procedures and Work Instructions shall specify recipients of reports, documents, and correspondence concerning design and Design Changes, as may be required. Correspondence between H. B. Zachry Company and the Architect/Engineer concerning design or Design Changes, shall be in accordance with requirements of H. B. Zachry QA Guide No. QAG-8, "Issuance, Receipt, and Processing of Correspondence."

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6.2.2 CASE II:

Whenever H. B. Zachry Company is responsible for the design of a nuclear facility, QA Procedures and Work Instructions shall specify design control requirements.

Quality Assurance interfaces between subcontractors responsible for design or portions of design and H. B. Zachry Company shall be specified in contract or project specific QA Procedures and Work Instructions, as appropriate. This may include the coordination of Quality Assurance efforts, the responsibility of personnel, or the review of subcontractor design.

Field Design Change reports shall be prepared by cognizant individuals in construction, reviewed by the Quality Assurance Manager at the project site, and forwarded to the department or subcontractor originally responsible for the design by the Quality Assurance Manager. The Field Design Change report shall contain the proposed or recommended Field Design Change, whenever feasible. The original organization responsible for design shall review the report, approve or disapprove the proposed Design Change, or make recommendations for changes as appropriate.

Design Changes resulting from nonconformances shall be reviewed by the Materials Review Board. (Ref. QAG-11, "The Materials Review Board"). Whenever Design Changes resulting from nonconformances are reviewed for disposition, representatives of the original design organization shall be a part of the Materials Review Board, as required by project specific QA Procedures and Work Instructions.

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Form QAF-7, "TEXT PAGE"

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Correspondence between the Quality Assurance Department of H. B. Zachry Company and design organizations subcontracting to H. B. Zachry Company shall be controlled as required by H. B. Zachry QA Guide No. QAG-8, "Issuance, Receipt and Processing of Correspondence", and applicable QA Procedures and Work Instructions.

6.3 INTERFACING WITH VENDORS AND SUPPLIERS:

Interfacing requirements resulting from contract or overlap of responsibilities in procuring materials, parts, and services shall be delineated in QA Procedures and Work Instructions.

QA Procedures and Work Instructions shall make provisions for:

- Owner review and/or approval of H. B. Zachry Company Procurement Documents, as may be required.
- Interfacing with vendors or suppliers for the receiving of materials, parts, or components by H. B. Zachry Company, whether the materials, parts, or components were procured by H. B. Zachry Company or procured for H. B. Zachry Company.
- Interfaces with vendors or suppliers to evaluate or audit their ability or continuing ability to supply Quality acceptable items. (Ref: QAG-15, "Vendor or Supplier Evaluation".)
- Interfaces with vendors or suppliers to perform H. B. Zachry Company source inspections of vendor or supplier production facilities, as may be applicable.

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Quality related correspondence with vendors or suppliers shall be handled as required by H. B. Zachry QA Guide No. QAG-8, "Issuance, Receipt, and Processing of Correspondence".

7. DOCUMENTATION:

Quality Assurance Procedures or Work Instructions generated in accordance with requirements of this Guide shall become records and shall be maintained in the Quality Assurance Document Files.

8. AUDITS:

This Guide shall be subject to periodic audit by the Quality Assurance Department to determine its implementation. Audits shall be conducted in accordance with requirements presented in applicable sections of H. B. Zachry QA Guide No. QAG-36, "Internal Audits".

9. FOLLOWUP AND REVIEW:

The Director, Quality Assurance shall determine the need for timely reviews of this Guide to assure its continued effectiveness and usefulness to the QA Program.

FQA II PROCEDURE NO. 507 PAGE NO. 1 OF 21 DATE APP'D. 10-2-74 DATE ISSUED 10-2-74	H. B. ZACHRY COMPANY INDUSTRIAL DIVISION NUCLEAR POWER DEPARTMENT QUALITY ASSURANCE MANUAL – TITLE – Handling, Inspection for Damage Dimensional Measuring of Containment Vessel Plates (Procedure for Job E-135)	REV.____ DATE____ REV.____ DATE____ REV.____ DATE____ REV.____ DATE____

1. PURPOSE:

The purpose of this procedure is to establish a basic plan for recording dimensional measurements and existing damage to the containment vessel plates, handling, and restoring of the plates after sandblasting and coating.

2. SCOPE:

The scope of work to be performed under this procedure includes the following:

2.1 Inspecting and recording of the relative storage locations of the plates as currently stored and after final storage.

2.2 Measuring and recording dimensions describing the location of the current plate supports, and assuring the supports will be placed in the same relative locations at the point of final storage.

2.3 Measuring and recording of the contour dimensions of the plates as currently stored and in final storage location.

2.4 Establishing locations of attachment to the plates for the lifting, and a sequence of operations for handling, transporting and rotating of the plates for the entire moving operations.

2.5 Visual inspection of the plates prior to and after handling for determination of existing surface damage.

PAGE 1

3. REFERENCES:

Project Specification: Specification No. 34-1.3 - "For the Painting of Containment Vessel Steel Plates and Miscellaneous Items" issued by the Puerto Rico Water Resources Authority dated June, 1974.

Manessmann Procedure for Handling and Storage.

4. DEFINITIONS:

4.1 Contractor: Zachry International of Puerto Rico, Inc., a subsidiary of H. B. Zachry Company.

4.2 Subcontractor: Bagwell Coatings, Inc., a Subcontractor to the Contractor.

4.3 Owner's Representative: Designated person or persons representing the Owner, Puerto Rico Water Resources Authority, assigned for the duration of the project.

5. RESPONSIBILITIES:

5.1 The Quality Assurance Field Manager and Quality Assurance Supervisor shall be responsible for implementation of this procedure, and shall assure by constant surveillance and auditing that the requirements established herein are followed.

5.2 The Owner's representative shall be responsible for:

a. Review and approval of this procedure before implementation.

b. Establishment of any additional hold points in the activities described herein desired by the Owner.

c. Providing, in writing, specific instructions on the location and final storage requirements for the plates, if other than specified in this Procedure.

5.3 The Contractor's construction department shall be responsible for performing the lifting, handling, transporting, rotating of the plates, and constructing coating and sandblast racks.

5.4 The Quality Assurance Field Manager shall be responsible for instructing individuals to take and record the measurements described in this procedure.

6. PROCEDURE:

6.1 The following procedure shall be followed in the sequence given for measuring, handling and visual inspection for surface damage of each containment vessel plate:

6.1.1 A drawing shall be prepared showing a plan view of the current storage area, relative positions of the plate stacks, identity and relative positions of the plates in each stack.

6.1.2 The existing tape covering the weld bevels shall be removed.

6.1.3 The weld bevels and top surface of the plate shall be visually inspected for any surface damage such as gouges and cracks. All damage shall be recorded on Form QAF-507-01.

6.1.4 The geometric location of the supports under the plate to be moved shall be determined by taking dimensions as shown on the appropriate Form, QAF-507-02, 03, or 04 and recorded in the appropriate table provided on these Forms. The supports shall be marked with unique identifying numbers and recorded in the respective locations given on these Forms.

6.1.5 A contour dimensional check for each plate shall be taken prior to any movement as shown on the appropriate Form QAF-507-05, 06, or 07 and recorded in the spaces provided on these Forms.

6.1.6 The lifting mechanisms utilized for lifting and moving the plate in the suspended position shall be attached to the plates at the approximate relative positions as described on Form QAF-507-08, for each respective plate geometry being handled. All grabs, hooks, clamps and slings utilized shall be provided with a surface that will prevent gouging and scratching during the handling operations, and approved for use by the Quality Assurance Field Manager.

6.1.7 The plate shall be lifted and suspended for visual inspection of the bottom surface for damage such as gouges and cracks. All damage shall be recorded.

6.1.8 The plate shall be lifted and transported in the flat position to the area immediately adjacent to the sandblast and coating rack.

6.1.9 The plate shall be rotated 90° to the vertical position. The approximate attachment points for this rotation are as indicated on Form QAF-507-09 for each basic plate geometry. All grabs, hooks, clamps and slings utilized for this rotation, lifting, and moving of the plate in the suspended position shall be provided with a surface that will prevent gouging and scratching during the handling operation, and approved for use by the Quality Assurance Field Manager.

6.1.10 The plate shall be placed in the sandblast and coating rack in the vertical position. The location of the plate in the rack shall be recorded in the Traveler for the Sandblast and Coating Operations.

6.1.11 Operations 6.1.1 through 6.1.10 shall be repeated until available space in the rack is filled. Handling operations shall be suspended at this time until vacant spaces in the rack can be established by the removal of blasted and coated plates.

6.1.12 Sandblasting and coating operations are described in procedure FQA-II-510 titled Surface Preparation and Coating.

6.1.13 After the blasting, coating and acceptance of these operations is complete, the plate shall be lifted from the rack and moved to the area for rotation.

6.1.14 The plate shall be rotated to the flat position by performing the reverse operation described in paragraph 6.1.9.

6.1.15 The plate shall be lifted and transported to the final storage area indicated by the Owner's representative. The plate shall be suspended for visual inspection of the bottom surface for damage such as gouges and scratches.

6.1.16 The plate shall be stored in the same stack location, same relative position in the stack (paragraph 6.1.1) with the plate supports in approximately the same location as determined in the original storage area (paragraph 6.1.4) unless otherwise directed in writing by the Owner's representative. The location of the supports shall be indicated on the surfaces of the plates by chalk prior to placing the plate on supports, and placing any supports on plates previously stored.

6.1.17 The plate shall be placed on the supports in the same position of support as determined in paragraph 6.1.4.

6.1.18 The plate weld bevels and top surface shall be inspected for visual damage such as gouges and scratches and all damage recorded.

6.1.19 A contour dimensional check for each plate shall be taken as shown on Forms QAF-507-05, 06, 07 and recorded in the spaces provided on these Forms.

6.1.20 A drawing shall be prepared showing a plan view of the final storage area relative positions of the plate stacks, identity and relative positions of the plates in each stack.

6.1.21 A plate traveler will be used to list specific operations or inspections that will be required before the next operation can begin. The traveler will indicate the approvals or signatures required before subsequent operations can begin. A traveler will be assigned to each plate and will accompany the plate throughout the entire operations.

7. DOCUMENTATION:

The documentation required by this procedure includes the following:

7.1 Damage Report, Form No. QAF-507-01

7.2 Support Locations, Form QAF-507-02

7.3 Support Locations, Form QAF-507-03

7.4 Support Locations, Form QAF-507-04

7.5 Contour Dimensional Check, Form QAF-507-05

7.6 Contour Dimensional Check, Form QAF-507-06

7.7 Contour Dimensional Check, Form No. QAF-507-07

7.8 Lifting Locations, Form No. QAF-507-08

7.9 Attachment Locations for Rotation, Form No. QAF-507-09

7.10 Traveler, Form No. QAF-511-02

7.11 Plan View of Storage Area as Currently Stored, Drawing No. FQA-II-507 (To be prepared at the beginning of the project)

7.12 Plan View of Storage Area as Finally Stored, Drawing No. FQA-II-507 (To be prepared at the end of the project)

The documentation will be maintained at the project site in accordance with the applicable sections of the H. B. Zachry Company Quality Assurance Manual Supplement Number II, until the contract for the work is complete. The documentation completed by the Subcontractor shall be controlled in accordance with the applicable sections of their Quality Assurance Program. The documentation generated by the Contractor will be controlled and access by individuals or organizations other than the Quality Assurance Field Manager or Supervisor will be granted only by approval of the Quality Assurance Field Manager. At the completion of work all documentation will be transmitted to the Owner or his specified representative.

8. AUDITS:

The Quality Assurance Department shall conduct periodic audits on the work performed under this procedure in accordance with the procedure presented in the H. B. Zachry Company Quality Assurance Manual Supplement Number II. Reports of all audit results will be forwarded to the Owner's representative for their review.

H. B. ZACHRY COMPANY QUALITY ASSURANCE		FORM QAF-507-01
– TITLE –		SER. No. _____
DAMAGE REPORT		DATE _____

Prepared by: _____

Stack No. _____
Plate No. _____
Plate ID. _____

Give Description of Damage:

Sketch configuration of plate, show approximate location of Plate Identification Stamp and horizontal orientation of plate as it was stored. Show approximate location of damage as described.

H. B. ZACHRY COMPANY QUALITY ASSURANCE

– TITLE –

INSTRUCTIONS FOR FORMS QAF-507-02, -03, -04

(Sheet 1 of 2)

SER. No. _____

DATE _____

Follow the steps indicated below for completion of forms QAF-507-02, QAF-507-03 and QAF-507-04:

1. Record Stack Number.
2. Record Plate Number of top plate.
3. Indicate location of Plate I.D. on drawing.
4. Record Plate I.D.
5. Mark I.D. on each support.
6. Record Support I.D. in space provided.
7. Indicate horizontal orientation of top plate in space provided.
8. From bottom surface of top plate take dimensions as follows:
   a. Dimension AT from extreme corner of plate.
   b. Transfer dimension AT to extreme edge of plate.
   c. Dimension BT.
   d. Dimension CT from extreme corner of plate.
   e. Transfer dimension CT to extreme edge of plate.
   f. Dimension DT.
   g. Repeat steps 8a through 8f for remaining supports.
9. Record Plate Number of plate immediately below the supports being located.
10. Indicate location of Plate I.D. of plate immediately below the supports being located.
11. Record Plate I.D. for plate immediately below the supports being located.

H. B. ZACHRY COMPANY QUALITY ASSURANCE

– TITLE –

INSTRUCTIONS FOR FORMS QAF-507-02, -03, -04
(Sheet 2 of 2)

SER. No. _____

DATE _____

12. Indicate horizontal orientation of plate immediately below top plate in space provided.

13. From top surface of the plate immediately below the supports being located take dimensions as follows:

    a. Dimension AB from extreme corner of plate.

    b. Transfer dimension AB to extreme edge of plate.

    c. Dimension BB.

    d. Dimension CB from extreme corner of plate.

    e. Transfer dimension CB to extreme edge of plate.

    f. Dimension DB.

    g. Repeat steps 13a through 13f for remaining supports.

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QAF-507-02

SER. No. _____

DATE _____

– TITLE –

SUPPORT LOCATIONS

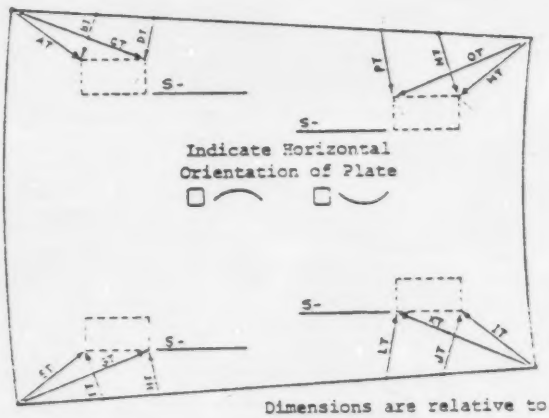
Measurements taken by: _____

NOTE: Indicate approximate location of Plate Identification Stamp by placing ◌ or ◯ on drawings below. ◯ = Top Side / ◌ = Under Side

Stack No. _____
Plate No. _____
Plate ID. _____

Dimensions

AT _____
BT _____
CT _____
DT _____
ET _____
FT _____
GT _____
HT _____
IT _____
JT _____
KT _____
LT _____
MT _____
NT _____
OT _____
PT _____

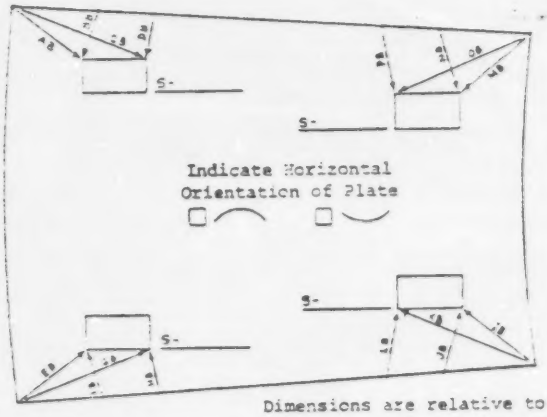


Dimensions are relative to the top of the support and the bottom surface of the plate resting on them

Stack No. _____
Plate No. _____
Plate ID. _____

Dimensions

AB _____
BB _____
CB _____
DB _____
EB _____
FB _____
GB _____
HB _____
IB _____
JB _____
KB _____
LB _____
MB _____
NB _____
OB _____
PB _____



Dimensions are relative to the bottom of the support and the top surface of the plate on which they rest

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QAF-507-03

SER. No. _____

DATE _____

– TITLE –

SUPPORT LOCATIONS

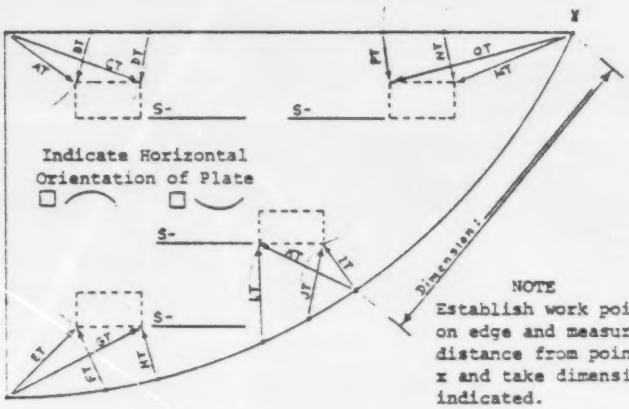
Measurements taken by: _____

NOTE: Indicate approximate location of Plate Identification Stamp by placing ◌ or ◯ on drawings below. ◯ = Top Side / ◌ = Under Side

Stack No. _____
Plate No. _____
Plate ID. _____

Dimensions

AT _____
BT _____
CT _____
DT _____
ET _____
FT _____
GT _____
HT _____
IT _____
JT _____
KT _____
LT _____
MT _____
NT _____
OT _____
PT _____



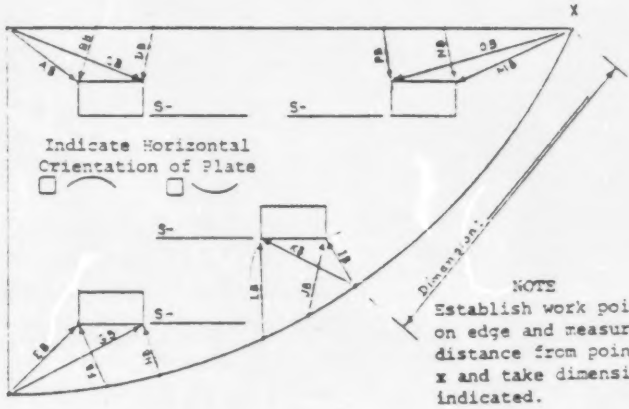
NOTE
Establish work point on edge and measure distance from point x and take dimensions indicated.

Dimensions are relative to the top of the support and the bottom surface of the plate resting on them

Stack No. _____
Plate No. _____
Plate ID. _____

Dimensions

AB _____
BB _____
CB _____
DB _____
EB _____
FB _____
GB _____
HB _____
IB _____
JB _____
KB _____
LB _____
MB _____
NB _____
OB _____
PB _____



NOTE
Establish work point on edge and measure distance from point x and take dimensions indicated.

Dimensions are relative to the bottom of the support and the top surface of the plate on which they rest

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QAP-507-04

SER. No. _____

DATE _____

– TITLE –

SUPPORT LOCATIONS

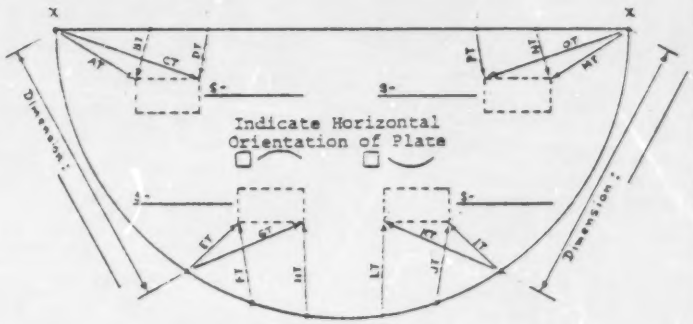
Measurements taken by: _____

NOTE: Indicate approximate location of Plate Identification Stamp by placing ◌ or ◯ on drawings below. ◯ = Top Side / ◌ = Under Side

Stack No. _____
Plate No. _____
Plate ID. _____

Dimensions

AT _____
BT _____
CT _____
DT _____
ET _____
FT _____
GT _____
HT _____
IT _____
JT _____
KT _____
LT _____
MT _____
NT _____
OT _____
PT _____



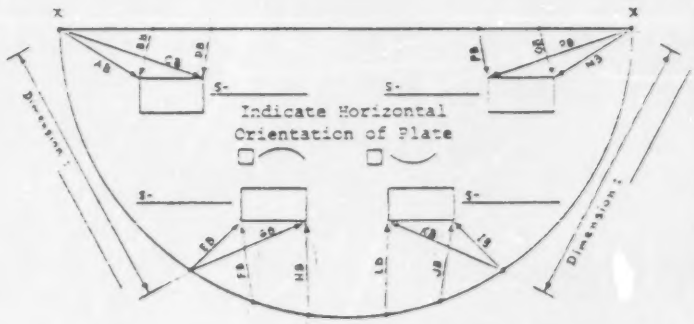
NOTE
Establish work point on edge and measure distance from point x and take Dimensions indicated.

Dimensions are relative to the top of the supports and the bottom surface of the plate resting on them

Stack No. _____
Plate No. _____
Plate ID. _____

Dimensions

AB _____
BB _____
CB _____
DB _____
EB _____
FB _____
GB _____
HB _____
IB _____
JB _____
KB _____
LB _____
MB _____
NB _____
OB _____
PB _____



NOTE
Establish work point on edge and measure distance from point x and take Dimensions indicated.

Dimensions are relative to the bottom of the support and the top surface of the plate on which they rest

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QAF-507-05

SER. No. _____

DATE _____

– TITLE –

CONTOUR DIMENSIONAL CHECK

Measurements taken by: _____ ☐ Pre - ☐ Post Handling

Determine the current horizontal orientation of the plate and take the dimensions indicated in the applicable method of measuring.

Cross out the drawing of the method NOT used.

The dimensions denoting where measurements are to be taken are to be taken from the entrance edge of the land on the weld bevel.

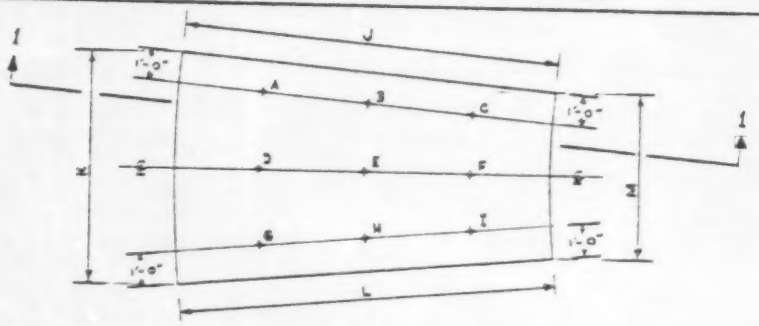
All measurements A thru I shall be normal to the plate surface at the points indicated in the true plane across the plate.

Indicate approximate location of Plate Identification Stamp by placing ◯ or (◌) on applicable drawing below. ◯=Top Side / (◌)=Under Side

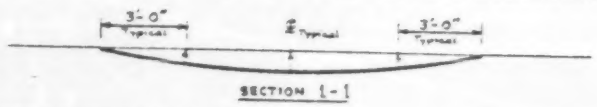
Stack No. _____
Plate No. _____
Plate ID. _____

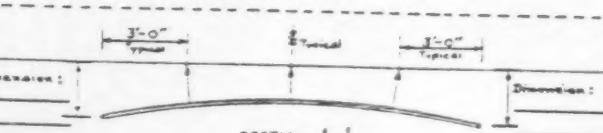
Dimensions

A	_____	F	_____	K	_____
B	_____	G	_____	L	_____
C	_____	H	_____	M	_____
D	_____	I	_____		
E	_____	J	_____		



Use Applicable Section 1-1





H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QAF-507-06

SER. No. _____

DATE _____

– TITLE –

CONTOUR DIMENSIONAL CHECK

Measurements taken by: _____ ☐ Pre - ☐ Post Handling

Determine the current horizontal orientation of the plate and take the dimensions indicated in the applicable method of measuring.

Cross out the drawing of the method NOT used.

The dimensions denoting where measurements are to be taken are to be taken from the entreme edge of the land on the weld bevel.

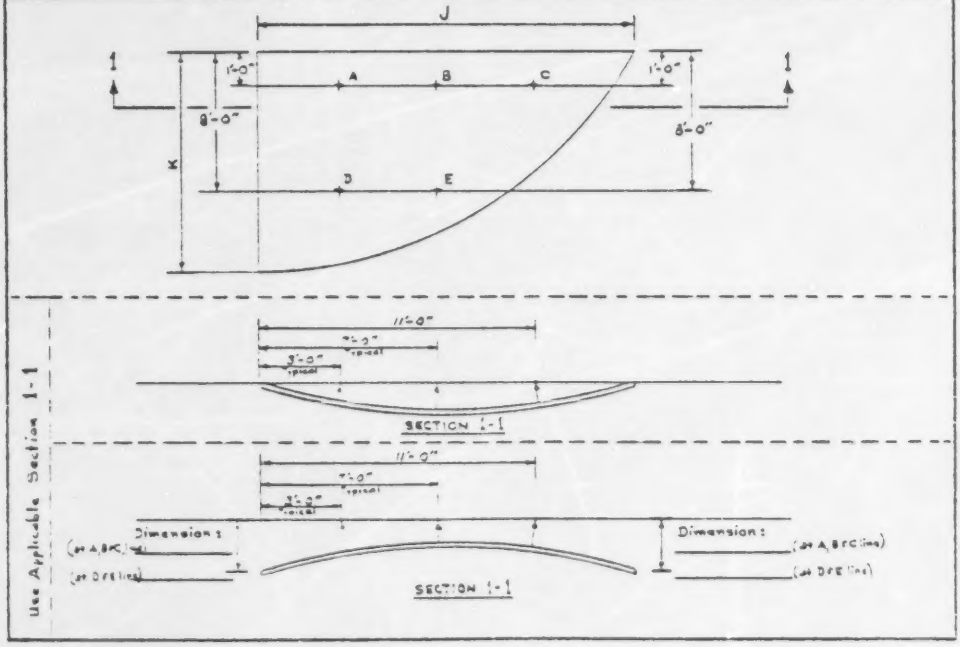
All measurements A thru I shall be normal to the plate surface at the points indicated in the true plane across the plate.

Indicate approximate location of Plate Identification Stamp by placing ◯ or ◌ on applicable drawing below. ◯-Top Side / ◌-Under Side

Stack No. _____
Plate No. _____
Plate ID. _____

Dimensions

A _____	F _____	K _____
B _____	G _____	L _____
C _____	H _____	M _____
D _____	I _____	
E _____	J _____	



H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QAF-507-07

SER. No. _____

DATE _____

– TITLE –

CONTOUR DIMENSIONAL CHECK

Measurements taken by: _____ ☐ Pre - ☐ Post Handling

Determine the current horizontal orientation of the plate and take the dimensions indicated in the applicable method of measuring.

Cross out the drawing of the method NOT used.

The dimensions denoting where measurements are to be taken are to be taken from the entreme edge of the land on the weld bevel.

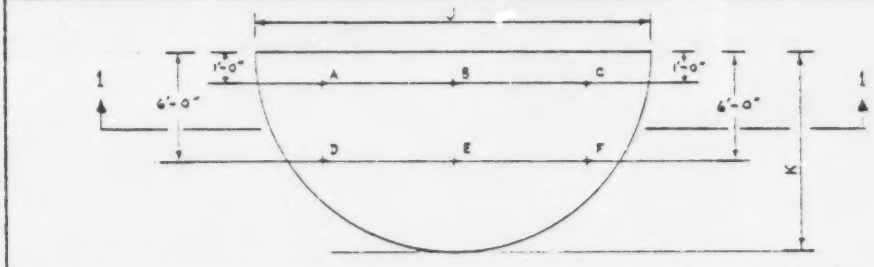
All measurements A thru I shall be normal to the plate surface at the points indicated in the true plane across the plate.

Indicate approximate location of Plate Identification Stamp by placing ◯ or ◌ on applicable drawing below. ◯=Top Side / ◌=Under Side

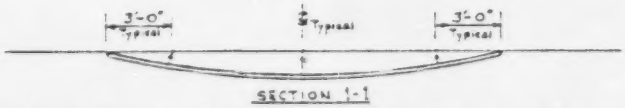
Stack No. _____
Plate No. _____
Plate ID. _____

Dimensions

A _____	F _____	K _____
B _____	G _____	L _____
C _____	H _____	M _____
D _____	I _____	
E _____	J _____	



Use applicable Section 1-1



SECTION 1-1

SECTION 1-1

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QAF-507-08

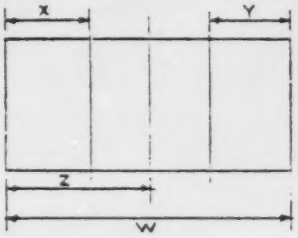
SER. No. _____

DATE _____

– TITLE –

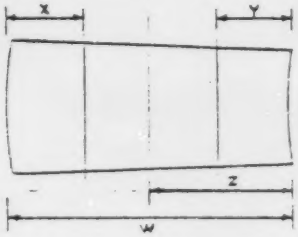
LIFTING LOCATIONS

CONFIGURATIONS: A thru Q, U, T1, T4 and T7 per Motor Columbus Drawing Number 1226.01.50C



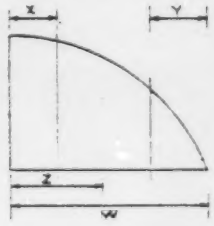
	X	Y	Z
A thru Q	6.0'	6.0'	12.5'
U	4.5'	4.5'	9.1'
T1	2.5'	2.5'	5.2'
T4	2.5'	2.5'	5.2'
T7	2.5'	2.5'	5.4'

CONFIGURATIONS: R, S, V and W per Motor Columbus Drawing Number 1226.01.50C



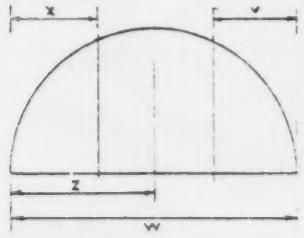
	X	Y	Z
R	5.0'	6.0'	11.6'
S	5.0'	7.5'	12.4'
V	4.5'	6.0'	10.3'
W	4.0'	7.0'	11.1'

CONFIGURATIONS: T2, T3, T5 and T6 per Motor Columbus Drawing Number 1226.01.50C



	X	Y	Z
T2	2.0'	5.5'	6.0'
T3	2.0'	5.5'	6.0'
T5	2.0'	5.5'	6.0'
T6	2.0'	5.5'	6.0'

CONFIGURATIONS: X001 and X002 per Motor Columbus Drawing Number 1226.01.50C



	X	Y	Z
X001	5.0'	5.0'	10.2'
X002	5.0'	5.0'	10.2'

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QAF-507-09

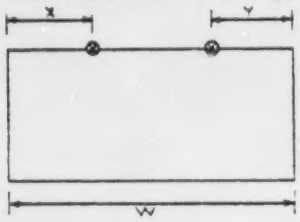
SER. No. _____

DATE _____

– TITLE –

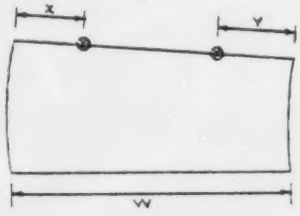
ATTACHMENT LOCATIONS FOR ROTATION

CONFIGURATIONS: A thru Q, U, T1, T4 and T7 per Motor Columbus Drawing Number 1226.01.50C



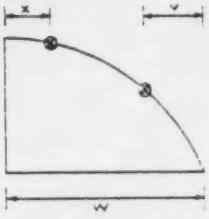
	X	Y
A thru Q	6.0'	6.0'
U	4.5'	4.5'
T1	2.5'	2.5'
T4	2.5'	2.5'
T7	2.5'	2.5'

CONFIGURATIONS: R, S, V and W per Motor Columbus Drawing Number 1226.01.50C



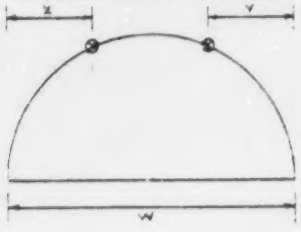
	X	Y
R	5.0'	6.0'
S	5.0'	7.5'
V	4.5'	6.0'
W	4.0'	7.0'

CONFIGURATIONS: T2, T3, T5 and T6 per Motor Columbus Drawing Number 1226.01.50C



	X	Y
T2	2.0'	5.5'
T3	2.0'	5.5'
T5	2.0'	5.5'
T6	2.0'	5.5'

CONFIGURATIONS: X001 and X002 per Motor Columbus Drawing Number 1226.01.50C



	X	Y
X001	5.0'	5.0'
X002	5.0'	5.0'

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QAF-511-02

SER. No. _____

DATE _____

– TITLE –

PLATE TRAVELER

(Sheet 1 of 2)

Plate Stack Identification _____ Plate Identification No. _____

Plate No. in Stack _____ Date Operations Started _____

For each item below the signatures indicated must be obtained in the space provided after the item was completed and before the next operation has been started.

Item	Signatures		Approval
1. Plate Stack I.D., Plate I.D. Plate No. in Stack recorded above.	Construction Rep		
2. Plate Supports identified and locations recorded.		Q.A. Rep	
3. Plate dimensions taken and recorded.		Q.A. Rep	
4. Plate inspection for visible surface complete and Owner's representative notified of any damage found and Damage Report complete.		Q.A. Rep	Owner's Rep
5. Plate transferred to rack and rack no. and area recorded below: _____ Rack No. _____ Rack Area No.	Construction Rep		
6. Plate surfaces inspected by Owner's representative and has designated areas to be cleaned and coated.		Q.A. Rep	Owner's Rep
7. Areas determined by 6 above are recorded.		Q.A. Rep	

H. B. ZACHRY COMPANY QUALITY ASSURANCE

– TITLE –

PLATE TRAVELER

(Sheet 2 of 2)

FORM QAF-511-02

SER. No. _____

DATE _____

Item	Signatures	Approval
8. Surface preparation and inspection complete and acceptable.	Q.A. Rep	Owner's Rep
9. Coating applied and inspected for runs, sags, cracks impregnated particles.	Q.A. Rep	Owner's Rep
10. Dry film thickness readings taken and acceptable.	Q.A. Rep	Owner's Rep
11. Plate placed in final storage area and stack I.D. and No. in stack recorded. _____ Stack I.D. _____ Plate No. in Stack	Q.A. Rep	
12. Plate dimensions taken and recorded.	Q.A. Rep	
13. Linseed oil placed on all weld preparations.	Construction Rep	
14. Final approval by Owner's representative received and indicated on Form QAF-511-03.	Q.A. Rep	

Read each question carefully. Be sure to provide the specific information each question requires. Make your answers brief. Use the backs of the test if you need more space.

1. List ten (10) essential elements or requirements that a typical quality assurance program must have as a minimum.

   a. _____

   _____

   b. _____

   _____

   c. _____

   _____

   d. _____

   _____

   e. _____

   _____

   f. _____

   _____

   g. _____

   _____

   h. _____

   _____

   i. _____

   _____

   j. _____

   _____

2. What is the purpose of a quality assurance/quality control manual?

   _____

   _____

2. (cont)

3. Describe the contents of the "Organization" section of quality assurance/quality control manual.

4. What is the relationship (if any) between quality assurance/quality control manuals and procedures?

5. Although quality assurance/quality control procedures vary in form and format from one organization to another, each document should contain ten (10) basic items or sections. Name the ten sections (items) and briefly describe the contents of each one.

a.

b.

5. (cont)

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

5. (cont)

i. _____

_____

_____

_____

j. _____

_____

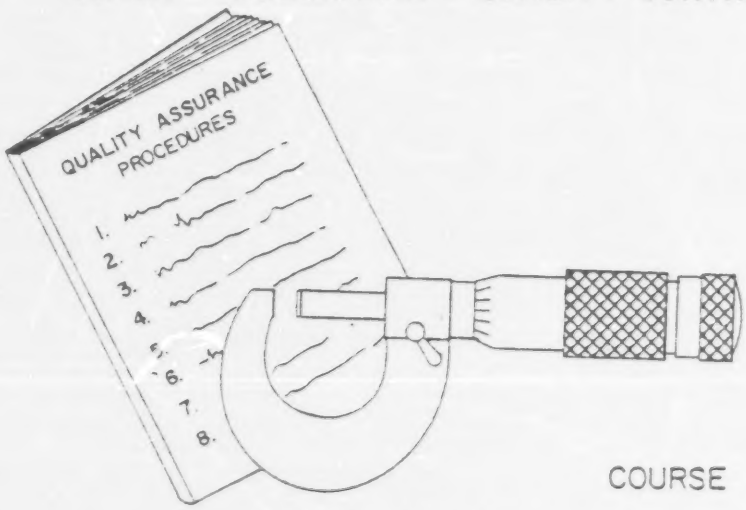
_____

_____

NUCLEAR TECHNOLOGY

MODULE 14-6 APPLICATION OF QUALITY ASSURANCE/QUALITY CONTROL TO INDUSTRY

INTRODUCTION TO QUALITY ASSURANCE / QUALITY CONTROL



COURSE 14

COURSE MODULES

COURSE 14 INTRODUCTION TO QUALITY ASSURANCE/QUALITY CONTROL

MODULE 14-1 Basic Requirements for Quality Assurance/ Quality Control

MODULE 14-2 Definitions and Descriptions of Quality-Assurance/Quality-Control Criteria

MODULE 14-3 Governmental Regulation of Quality Assurance/Quality Control (AEC, NRC)

MODULE 14-4 Technical Regulation of Quality Assurance/ Quality Control (ASME, ANSI)

MODULE 14-5 Implementation of Quality-Assurance/ Quality-Control Programs and Procedures

MODULE 14-6 Applications of Quality Assurance/Quality Control to Industry

MODULE 14-7 Techniques and Variations in Quality Assurance/Quality Control

MODULE 14-8 Quality-Assurance/Quality-Control Records and Documents

MODULE 14-9 Special Studies in Quality Assurance/ Quality Control

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Technical Education Research Center
Southwest
4201 Lake Shore Drive, Suite 111
Waco, Texas 76710

INTRODUCTION

The requirements for quality assurance and quality control are contained in:

Appendix B, 10CFR50.

ASME Boiler and Pressure Vessel Code, Articles NA-4000 and CA-4000.

ANSI Standards N45.2.

Quality-assurance manuals are written by various organizations (e.g., engineers, component manufacturers, fabricators, constructors and utility companies) to provide a broad basis for implementing and applying their quality-assurance programs. Specific instructions to employees (e.g., technicians, inspectors, welders, electricians, laborers) are presented in procedures (which reflect the requirements of 10CFR50, ASME Code and ANSI Standards).

This module explores application of quality-assurance requirements to the nuclear industry, as related to design and engineering, manufacturing, construction and services, and plant operation and maintenance.

MODULE PREREQUISITES

The student should have completed all previous modules in this Course.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. List five specific requirements of 10CFR50, ASME Code and ANSI Standards for quality assurance/quality control affecting the following applications:
   - Design and engineering of materials, components and facilities.
   - Manufacturing of materials and components.
   - Construction, testing and inspection of nuclear facilities.
   - Operation and maintenance of a licensed nuclear facility.
2. Prepare a classroom presentation describing basic elements of a complete quality-assurance/quality-control program for a nuclear facility, involving design, manufacturing, construction, testing, inspection, operation and maintenance.

Publication of NRC Regulatory Guides and ANSI N45.2 Standards made it possible for industry to be precise and realistic in its application of quality-assurance/quality-control requirements to the numerous phases of design, construction and operation of nuclear facilities.

It is important to realize that the owner or licensee of a nuclear facility retains a major responsibility for that facility. The owner is responsible, under terms of the NRC (and other regulatory agencies) license, to ensure that the owner's organization, as well as all other organizations participating in the facility, perform within the provision of the owner's license and quality-assurance program.

Every structure, system and component of a facility is important to that facility: design, fabrication, construction, testing and operation are equally important; therefore, the owner, engineer, constructor and operator of a nuclear facility must acknowledge that importance in its quality-assurance program.

QA/QC IN NUCLEAR DESIGN AND ENGINEERING

In an application for a license to own or operate a nuclear facility, NRC must be provided with all design data for that facility, including:

Output (in megawatts of thermal and electrical power generated).

Size and type of nuclear steam supply system to be employed (PWR, BWR, HTGR or BR).

Size and type of reactor housing structure and other nuclear components and systems.

Other basic engineering and design information, sufficient to allow NRC and other authorities to issue necessary permits and licenses in best interest of the public.

The design organization, whether an outside firm or a part of the owner's organization, must have a quality-assurance program and manual to govern its activities related to the facility. In addition to requirements stated in preceding modules, the following requirements are considered most important in design and engineering:

Design of all structures, systems and components must be consistent with design basis for facility.

Design calculations performed by one engineer must be checked and verified by another, equally qualified engineer reporting to someone other than the original designer.

Changes and modifications to a design must be presented to the original design organization for consideration and evaluation of change.

Original design organization must make (and approve) changes to original design, unless owner refers changes to another qualified organization.

Materials must be compatible with system design and its intended use.

Engineering and design activities must be fully documented and controlled, and must be regularly audited by owner or designated representative.

QA/QC IN NUCLEAR MANUFACTURING AND PRODUCTION

In addition to engineering and design calculations, the design basis covers materials and manufactured components to be included in design. Manufacturers of materials and fabricated equipment must also ensure that their activities are consistent with owner's quality-assurance program (and facility's license provisions); therefore, manufacturers of materials and components must have predetermined production procedures to ensure that their products, when used in a nuclear facility, will not cause undue hazards to the public.

All manufacturers must have quality-assurance programs and manuals consistent with their lines of business. Such programs are usually customized to show prime responsibilities and necessary interfaces (with other organizations), including owner, designer, constructor and operator.

Quality assurance in manufacturing must include, in addition to the uniform requirements referenced in preceding modules, the following important elements:

Procedures to interface activities among owner's design representatives and those of manufacturers.

Procedures to ensure that owner's purchase orders, technical specifications and engineering drawings are accurately translated into shop details and manufacturing instructions.

Procedures to ensure that raw materials used in producing other commodity materials are documented and identified through markings and identifications for purposes of traceability and verifications.

Procedures to ensure that personnel involved in special processes (such as welding, nondestructive test-

ing and other processes) are duly qualified and certified.

Procedures to ensure that testing and evaluation methods (used to verify product or material performance) are qualified and documented to the extent necessary to prove product or material integrity.

Procedures to ensure that packaging, transportation and handling of materials and components are designed to protect such products from damage or change between manufacturing facility and nuclear facility.

Other procedures and provisions considered essential or unique to the product, to the manufacturing process or to the performance of material or equipment produced.

QA/QC IN NUCLEAR CONSTRUCTION AND SERVICES

The constructor must have a comprehensive, viable quality-assurance program to comply with the many types of construction specifications and other requirements. (The design engineer and manufacturers, on the other hand, use codes and standards for performing their activities.) The constructor relies upon project specifications and engineering drawings for guidance to construct the facility. And, in effect, the project specifications become construction standards for the constructor to follow - an important reason why the constructor must have a comprehensive quality-assurance program encompassing the nuclear facility from foundation work to trial operation.

The quality-assurance program of a construction organization, therefore, must meet standard requirements described in preceding modules and the following additional requirements:

Activities performed by contractor must comply with project specifications, drawings and owner's quality-assurance program.

Activities performed by subcontractors, under contractor supervision, must comply with requirements imposed on contractor by owner.

Purchases of permanent materials made by the constructor or subcontractors must fully comply with requirements of project specifications and quality-assurance program.

Materials received at construction site, whether procured by constructor or other organizations, must be inspected for quantity and quality-assurance compliance, and must be stored in full compliance with approved quality-assurance procedures.

Materials to be used by constructor, whether furnished by constructor or by other participating organizations, must be checked and verified as to correctness and application in accordance with project drawings and specifications.

Warehousing, storage and environmental protection of materials, components and equipment must be controlled to ensure that only approved items are issued for installation.

Nonconforming items must be separated from acceptable items, documented, and their nonconformity resolved in accordance with pre-established and approved procedures.

QA/QC IN OPERATION AND MAINTENANCE OF NUCLEAR FACILITIES

The Preliminary Safety Analysis Report (PSAR) states in detail what an owner plans to do in the design, procurement and construction phases (of a nuclear facility); the Final Safety Report (FSR) updates this information with an account of what has actually occurred at the facility and states how the owner intends to operate and maintain the facility in a safe manner.

As with all participating organizations in a nuclear facility, the owner-operator must have a comprehensive quality-assurance program. This program must describe, in detail, how plant operation will be performed within the guidelines and provisions of the NRC operating license. In addition to the standard and common requirements stated in preceding modules, the operations quality-assurance program must include the following items:

Designation of responsible organization for safe operation of facility, if different from owner's organization. (In some cases, a facility may be owned by several companies and operated by a managing company or an operating group. The owner or owners retain responsibility for plant operation, but must designate an operating group as agent.)

Safety standards that must be met and maintained during receiving, storage, handling and loading of nuclear fuels into reactor.

Safety standards that must be met and maintained during removal of spent fuels from reactor.

Safety standards to be observed during startup, on-line operation and shutdown of reactor system.

Indoctrination, qualification and certification of operating and maintenance personnel.

Preparation, certification and retention of operating records and data.

Preparation, implementation and enforcement of plant security system.

Installation, retrieval, testing and maintenance of irradiation and other test samples required by safety standards of plant.

Preparation, reporting and transmittal of operating experience to regulatory agencies to verify compliance with operating license provisions and reactor power level designations.

EXERCISES

None.

MATERIALS

None.

PROCEDURES

1. Review Module 14-2, "Definitions and Descriptions of QA/QC Criteria," and 14-5, "Implementation of QA/QC Programs and Procedures;" outline quality-assurance requirements for constructing a nuclear facility; highlight more important aspects of quality assurance for owner of the facility, and for the designer, the engineer and the constructor.
2. Review one or more of the "rainbow" books (specifically, the quality-assurance requirements for a nuclear facility, or a portion thereof); prepare a classroom presentation, describing the most important elements of a quality-assurance program for the selection of your choice; point out references to Quality Assurance Criteria, ANSI Standards or ASME Code to program you describe; explain why you reached the decisions you made.

DATA TABLE

None.

American Society of Mechanical Engineers. ASME Boiler and Pressure Vessel Code. New York: ASME.

_____. "Quality Assurance Requirements for Nuclear Power Plants," ANSI N45.2 - 1971. American National Standard, Reactor Plants and Their Maintenance. New York: ASME, 1971.

U.S. Atomic Energy Commission. Code of Federal Regulations, Title 10 - Atomic Energy, Appendix B. Federal Register 35, No. 125, June 1970.

_____. "Guidance on Quality Assurance Requirements During the Construction Phase of Nuclear Power Plants." Rainbow Series, Green Book. May 1974.

_____. "Guidance on Quality Assurance Requirements During Design and Procurement Phase of Nuclear Power Plants," Revision 1. Rainbow Series, Gray Book. May 1974.

_____. "Guidance on Quality Assurance Requirements During the Operations Phase of Nuclear Power Plants." Rainbow Series, Orange Book. October 1973.

_____. "Status Summary Report: Data for Decisions." Rainbow Series, Yellow Book. May 1974.

USAEC documents available by writing Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Read each question carefully. Be sure to provide the specific information each question requires. Make your answers brief. Use the backs of the test if you need more space.

1. List five requirements stated in this module for quality assurance/quality control in the design and engineering of a nuclear facility.

   a. _____

   _____

   _____

   b. _____

   _____

   _____

   c. _____

   _____

   _____

   d. _____

   _____

   _____

   e. _____

   _____

   _____

2. List five requirements for nuclear facilities, stated in this module, for quality assurance/quality control in the manufacturing of materials and components.

   a. _____

   _____

   _____

2. b. _____

c. _____

d. _____

e. _____

3. List five requirements stated in this module for quality assurance/quality control of a construction organization for a nuclear facility.

a. _____

b. _____

c. _____

d. _____

3. e. _____

_____

_____

4. List five requirements stated in this module for quality assurance/quality control in operation and maintenance of nuclear facilities.

a. _____

_____

_____

b. _____

_____

_____

c. _____

_____

_____

d. _____

_____

_____

e. _____

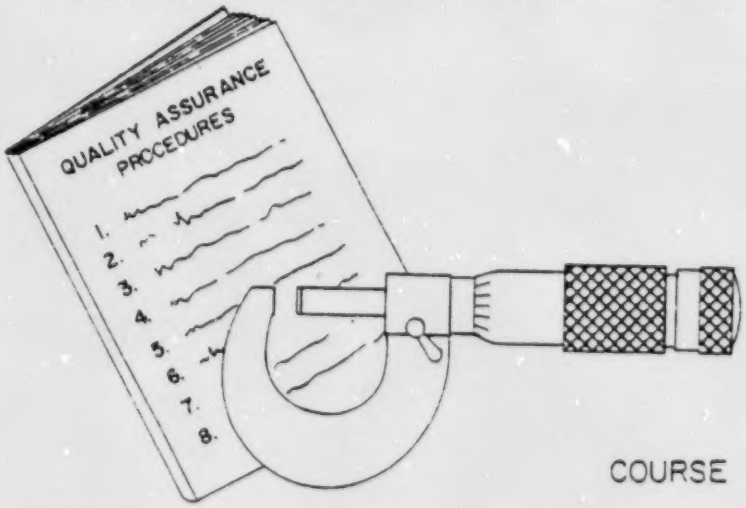
_____

_____

NUCLEAR TECHNOLOGY

MODULE 14-7 TECHNIQUES AND VARIATIONS IN QUALITY ASSURANCE/QUALITY CONTROL

INTRODUCTION TO QUALITY ASSURANCE / QUALITY CONTROL



COURSE 14

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Technical Education Research Center
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INTRODUCTION

Before publication of the Regulatory Guides, Rainbow Books and ANSI N-45 Standards, presentations of quality assurance/quality control to industry by ASME and NRC provides no associated instructions or methods or procedures to assist in translating requirements into workable programs. Therefore, organizations required to comply with quality assurance/quality control had to look for assistance (anyone with experience) to implement provisions to the satisfaction of ASME and NRC.

Unfortunately, the search was difficult and, more often than not, fruitless. Quality assurance was new to the industry.

Regardless, quality-assurance requirements were met with earnest effort and serious determination to fulfill the need of making the nuclear industry safe to the public. The diversification of methods and techniques, however, resulted in quality-assurance programs customized for each user organization.

This module demonstrates that an owner must consider first its own needs before undertaking the task of meeting challenges of complying with all that is required of the nuclear industry.

MODULE PREREQUISITES

The student should have completed all previous modules in this Course.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Describe an owner's unassisted quality-assurance program and point out its advantages and disadvantages.
2. Describe consultant-assisted quality-assurance programs and critique each program type.
3. List essential requirements in subcontracting quality-assurance/quality-control functions to other organizations.
4. Enumerate a variety of forms and records typically used in implementing quality-assurance/quality-control requirements.
5. Prepare one or more quality-assurance/quality-control forms to document an activity of nuclear design, manufacture, construction, or operation of a nuclear material, component or facility.

Organizations within the nuclear industry vary widely in size, structure, involvement and interest. The owner of a nuclear facility has the major responsibility for that facility because of the nature of the licensing requirements. Therefore, in describing the many variations in quality assurance, frequent reference is made to owners so that an understanding of the system's complexity may be established. By modeling from owner techniques, the design engineers, manufacturers, constructors and others may easily arrive at the necessary basics for developing their individualized quality-assurance programs.

It should be realized that at this stage of development of the nuclear industry and quality assurance, emphasis must be placed on the substance of the program rather than its form or format. In other words, an engineering firm must limit its programs to its involvement (usually design only). Programs are not judged on their bulk, writing style or format; they are judged, rather, on their preciseness, substance and intimacy in working with the organization they serve.

USER'S "UNASSISTED" QA/QC PROGRAMS

An unassisted quality-assurance program is one that has been developed, prepared and published by the same organization that intends to use it.

The most important step in developing a user's program

is management decision to appoint and authorize a responsible staff member to supervise program development. This responsible individual is usually designated quality-assurance director or quality-assurance manager. The first duty of this position is to select a competent staff. The selection process includes careful evaluation of each applicant's knowledge and experience, competence and potential for responsibility. Also, ability and desire to cooperate and work well with others, and length of service and familiarity with the organization and its mode of operation are evaluation criteria.

The selected staff should be fully appraised of the company's policies regarding program objectives. After the initial introduction to assignments, the staff should obtain all available regulations and study the mandatory as well as optional requirements. From this material the staff prepares procedures and instructions (relating quality-assurance requirements to work to be accomplished).

With the support of the organization's management, the quality-assurance staff meets with production supervisors and craftsmen to discuss and finalize production methods and procedures. This phase of development of quality-assurance information is most important; real communication between personnel of the same company can result in quality-assurance procedures that are accurate, descriptive of production details, and in full compliance with quality-assurance requirements.

CONSULTANT-ASSISTED QA/QC PROGRAMS

A consultant-assisted quality-assurance program is one established with the assistance of a professional QA/QC consultant or consulting group. An important criterion of this type program is that the program user establish its policies first, and then choose a consultant. The user must designate a quality-assurance director or manager to work closely with the consultant to ensure that the consultant works within those established policies.

Usually, a consultant-assisted program is chosen by a newcomer to the nuclear field, or by smaller organizations (with ten or fifteen employees), or organizations having to meet a close deadline for providing a quality-assurance program.

Other organizations may solicit consultant help in outlining and structuring an entire program, including proposed organizational charts and functional position; however, more commonly, an organization solicits and contracts for the services of a consultant to receive only guidance and direction for the organization's own staff.

SUBCONTRACTED QA/QC

Subcontracting quality-assurance functions to others has been practiced in some areas of the nuclear industry, but only as a means to utilize the best available expertise. Subcontracting does not reduce the responsibility of the owner.

Organizations prepared to accept subcontracts for performing quality assurance for others must meet all the previously noted qualifications and requirements.

The most commonly subcontracted services include:

Vendor surveys and evaluations for major component procurements.

Vendor's shop-performance inspections and documentations.

Nondestructive examinations and documentations.

Destructive testing of concrete samples.

Destructive testing of welder's performance qualification samples.

Records and document management services.

QA/QC PROCEDURES, CHECKLISTS AND RECORDS

Quality assurance has been defined (Module 14-2, "Definitions and Descriptions of QA/QC Criteria") as those actions taken by quality-assurance personnel to provide adequate confidence that an item or work activity has the degree of excellence and characteristics to perform satisfactorily in service. Records must be available to document the existence of this predetermined quality.

In addition to the quality-assurance program outline described in Module 14-5, working procedures for the control of certain activities must be developed. These procedures must be responsive to requirements of the quality-assurance manual. The results obtained from implementing each procedure should be recorded and verified to provide

documentation that the predetermined quality has been achieved.

Note: Appended to this module are forms for student's use in understanding and practicing "documentation."

EXERCISES

List the advantages and disadvantages of a user's unassisted quality-assurance program. Elaborate on the items noted in this module and add any new items that come to mind.

MATERIALS

None.

PROCEDURES

None.

DATA TABLE

None.

REFERENCE MATERIALS

U.S. Atomic Energy Commission. "Quality Assurance Criteria for Nuclear Power Plants." Code of Federal Regulations, Title 10 - Atomic Energy. Federal Register 35, No. 125, June 1970.

Available by writing the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

A P P E N D I X

Courtesy of H.B. Zachry Company
San Antonio, Texas.

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QA 201

SER. No. 001

DATE 4/11/75

– TITLE –

DRAWING/SPECIFICATION LOG SHEET

JOB # 1888-1 JOB NAME _____

DRAWING # M-295 Rev. 1 / SPECIFICATION # M-4 Rev-0

DWG./SPEC. TITLE Main Steam Piping LOG SHEET PG. # 001

ISSUE THIS (DWG.) / (SPEC.) TO: Travis Hill

TOTAL # OF COPIES ISSUED 2/1 BY J. Downey

HISTORY OF REVISIONS

REVISION NUMBER	DATE TRANSMITD	YES OR NO PREVIOUS DWG./SPEC VOIDED	YES OR NO DWG./SPEC RETRIEVED **	NO. OF COPIES TRANSMITTED DWG.	NO. OF COPIES TRANSMITTED SPEC.	RECEIVED BY
1	4/2/75	Yes	No	2		Travis Hill
0	4/2/75	N/A				Travis Hill

SAMPLE FORM

** If drawing or specification has been lost, assignee must so indicate and initial.

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QA 202

SER. No. 001

DATE 4/1/75

– TITLE –

DRAWING LOG SHEET INDEX

JOB # 1888-1 JOB NAME _____

LOG SHEET SERIAL #	DRAWING #	DRAWING TITLE	RECEIVED FROM	DATE RECEIVED
001	M-295	Main Steam Piping	TUSI	4/1/75

SAMPLE FORM

H. B. ZACHRY COMPANY QUALITY ASSURANCE

– TITLE –

VENDORS QUALIFICATION SURVEY

FORM QA 301

SER. No. 001

DATE 3/15/75

COMPANY NAME Piping Fabricators, Inc.

DIVISION

ADDRESS 1001 Jenkins
Raul, Texas 85555

TELEPHONE 555-000-0000

PERSON CONTACTED Bill Odis, Plant Manager
Leroy Miller, Quality Assurance Manager

SURVEY CONDUCTED FOR Qualification of vendor to fabricate main steam piping per 1974 ASME Code

SAMPLE

1. Do you have an operating Quality Control Program ? Yes X No
2. Do you have a Quality Control Manual ? Yes X No
3. Is the Manual available for review ? Yes X No
4. Do you have written Quality Control Procedures ? Yes X No
5. Do you intend to develop Quality Control procedures ? Yes X No
6. When will these procedures be available for review ? Date Reviewed during Survey
7. Who is responsible for your Quality Control Program ? NAME Leroy Miller
8. Who does he report to ? NAME J. A. Savage TITLE Vice President, Operations
9. Do you have instrument and equipment calibration schedule and logs ? Yes X No
10. Name your calibration testing lab
Name Calibration Testing Labs
Address Raul, Texas 81001
11. Do you have Quality Assurance procedures for purchase of materials ? Yes X No
12. Do you have Quality Assurance procedures for receiving and storage of materials ? Yes X No
13. Do you have Quality Assurance procedures for release of material from warehouse to production ? Yes X No
14. Do you have Quality Assurance procedures for resolution of nonconformities of materials ? Yes X No
15. Do you have Quality Assurance procedures for resolution of nonconformities of workmanship ? Yes X No
16. Do you control repairs of nonconformities of materials or workmanship ? Yes ___ No ___
17. Name your code inspection agency
Name Main Boiler Insurance Company
18. Do you have any ASME Symbol Stamps ? If "Yes" Yes X No
19. Which ones ?
20. Name your NDE Subcontractor Name N.D.E. Inspectors
Address Raul, Texas 81001

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QA 203

SER. No. 001

DATE 4/1/75

– TITLE –

SPECIFICATION LOG SHEET INDEX

JOB # 1888-1 JOB NAME _____

LOG SHEET SERIAL #	SPEC. #	SPECIFICATION TITLE	RECEIVED FROM	DATE RECEIVED
001	M-4	Main Steam Piping	TUSI	4/1/75

SAMPLE FORM

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QA 901

SER. No. 001

DATE 10/21/75

– TITLE –

WORK PROCESS TRAVELER

JOB NO. E-1970
SYSTEM Main Steam
LINE NO. MS-001
MARK NO. MS

DRAWING NO. MS-295
FIELD DWG. None
OTHER None

SHEET NO. 1 OF 1
DATE 10/21/75
PREPARED BY R Hodges

Instructions: Place N. A. in all spaces that do not require information; Place a check mark (✓) in appropriate column for inspection point notification

Item No.	Description of Work	Procd. No.	Required Inspection Points * Auth. Insp.	Date	✓ HBZ Insp.	Date	Comp. Date
1	Fit-up MS-001-d to superheat Outlet Header	MA-55	G.R.	10/21/75	✓ G.C.	10/21/75	10/21/75
2	Preheat to 450°F weld root pass with 3/32" d.a. E 7015-B3 electrode	MA-55			✓ G.C.	10/22/75	10/22/75
3	Complete welding with 1/8" & 5/32" d.a. E-7015-B3 electrode maintain 450°F preheat	MA-55			✓ G.C.	10/23/75	10/23/75
4	Stress relieve weld at 1750°F MA-55 for 6 hrs				✓ G.C.	10/24/75	10/24/75
5	Grind weld surface for Radiography	GPS			✓ G.C.	10/24/75	10/24/75
6	Radiograph weld & review radiographs		G.R.	10/25/75	✓ G.C.	10/25/75	10/25/75

SAMPLE

Issued By: Construction R. Hodges

Approved By: Quality Assurance G. Cain

Authorized Inspector G. Weisberger

* Authorized Inspector Inspection Points

H. B. ZACHRY COMPANY QUALITY ASSURANCE

– TITLE –

HOLD TAG

FORM QA 405

SER. No. 004

DATE 10/15/75

JOB NO. I-1970 FORM QA 405

TAG # 004

H. B. ZACHRY COMPANY

ITEM 3 P.O. HO 45

REFER TO NCR # 009

HOLD

DO NOT	AWAITING
☑ MOVE	☐ DOCUMENTATION
☐ INSTALL	☐ PARTS MISSING
☐ CLEAN	☐ REPAIR
☐ CONNECT	☐ M.R.B. ACTION
☐ OPERATE	☐ PROCEDURE
☐ INSULATE	☐ REMOVAL
☐ PAINT	☑ Examination
☐ USE: REJECTED	☐ Containers

BY G Cain DATE 10/15/75

TAG # 004

H. B. ZACHRY COMPANY

ITEM 3 P.O. HO 45

LOCATION Hold area - Sect. I

HOLD FOR Examination

DISPOSITION Accept

BY G Cain DATE 10/15/75

SAMPLE

21. Have you performed this type work before? Yes X No ___

22. Where Raul, Texas - U. S. Mission Power Plant

23. To what extent Complete procurement of materials and fabrication of main steam piping

24. When 1974

25. Can you guarantee compliance with our specifications and procedures for the proposed work? Yes X No ___

26. How? By implementation of their Quality Assurance System

27. Why not? ___

28. Can you meet our delivery requirements? Yes X No ___

29. Do you have a record retention program? Yes X No ___

30. How are records approved? By qualified and predesignated personnel authorized to approve specific records

31. How can duplicate records be obtained? Only by written request and approval of such by the Quality Assurance Director and Plant Manager

32. Who should be contacted for arrangement for in-progress inspection during work? NAME Bill Idis
TITLE Plant Manager

33. Do you maintain current codes and standards? Yes X No ___

34. Which ones? ASME Boiler and Pressure Vessel Code, ANSI B31.1 Power Piping Code, ASME Standards

35. Who is in charge of keeping codes current? Quality Assurance Department
NAME Jack Smith
TITLE Quality Assurance Records Engineer

36. Do you have resume's and experience records of personnel for our work? Yes X No ___

REMARKS: Quality Assurance program procedure, organization, and procedures were reviewed and witnessed being implemented. Program complies with Appendix A-300 of Section I of Code and implementation was in accordance with Quality Assurance Manuals.

Survey Conditions: ___

Recommendations: Main Steam Piping Fabricators be an approved vendor and be placed on the Approved Vendors List for fabrication of main steam piping.

Surveyed by: J. D. Bennett
Date: 3/13/75

Approved by: M. A. Fabel
Date: 3/15/75

REMARKS:
Per the recommendations, the Vendor, Piping Fabricators, Inc. are considered approved vendors for main steam piping and added to the approved vendors list.

H. B. ZACHRY COMPANY QUALITY ASSURANCE		FORM QA 30 1
– TITLE –		SER. No. 001
APPROVED VENDORS LIST		DATE 3/17/75

VENDOR'S NAME AND ADDRESS	PRODUCT	DATE APPROVED / REMARKS
Piping Fabricators, Inc 1002 Jenkins Raul, Texas 85963	Main Steam Piping	3/16/75 Approved for fabrication of main steam piping

SAMPLE FORM

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QA -02

SER. No. 001

DATE 10/15/75

– TITLE –

RECEIVING & INSPECTION REPORT

JOB # I-1970 JOB NAME Calaveras Power Plant

(1) Purchase Order No. HO 45 (2) Vendor Electrode Supply

(3) Shipper T & P Railroad (4) Shipped From Raul, Texas

(5) VIA: Express, Truck, Parcel Post, (Check One) Rail

Air Freight, Vessel (Name and No.)

(6) Consigned to: H.B Zachry Co (7) Seal Number N.A.

(8) Seal Broken By N.A (9) Bill of Lading No. 95456

(10) Started Unloading 10/15/75 Date 9:00 a.m. Time

(11) Completed Unloading 10/15/75 Date 9:30 a.m. Time

(12) Trucking Co. & No. H&T Truck (13) Number of Packages 3-Pallets

(14) Weight of Packages 6620 lbs (15) Type of Packing Pallets

(16) Condition of Containers 2-50 lb. containers damaged on 3/32" dia

(17) QTY	(18) DESCRIPTION	(19) I.D. MARK (LEGIBLE)	(20) DOCUMENTS REQUIRED YES	NO	(21) DOCUMENTS COMPLETE W/ SHIPMENT YES	NO	(22) STORAGE LOCATION	(23) ACCEPT OR HOLD
1200 lb	E-9018-B3 3/32" Dia. Welding Electrodes	yes	✓		✓		Bin 45	Accept
2-00 lb	E-9018-B3 1/8" Dia. Welding Electrodes	yes	✓		✓		Bin 46	Accept
3000 lb	E-9018-B3 5/32" Dia. Welding Electrodes	yes	✓		✓		Bin 47	2900 lb Accept 100 lb Hold

(24) REMARKS: (Fill in complete details) See N.C.R. 001 for 2 electrode containers damaged upon receipt. These containers are tagged Hold and placed in Hold areas pending disposition.

(25) Signature G. Cain

(26) Received & inspected by T Hendricks Date 10/15/75

(27) Quality Assurance Verification G Cain Date 10/15/75

(28) Document Distribution Doc's to QC BY T Hendricks Date 10/15/75

To be filled out by the Receiving Clerk

To be filled out by the Quality Assurance Supervisor, Receiving Inspection

SAMPLE

H. B. ZACHRY COMPANY QUALITY ASSURANCE		FORM QA 403
– TITLE – ACCEPTED TAG		SER. No. _____
		DATE _____

JOB NO. I-1970 FORM QA 403

H. B. ZACHRY COMPANY

QA/QC ACCEPTED

#3 100 Lb. E-9018-B3

ITEM Welding Electrodes 3/32" Dia.

P.O. # HO 45

REC'NG REPORT # 001

QA C. Cain

DATE 10/15/75

If Accepted See HOLD

HOLD NOTICE # 004

NON-CONFORMANCE REPORT # 009

QA C. Cain

DATE 10/20/75

SAMPLE

H. B. ZACHRY COMPANY QUALITY ASSURANCE

FORM QA 404

SER. No. 009

DATE 10/15/75

– TITLE –

NONCONFORMITY REPORT

JOB # I-1970
SYSTEM
PART Welding Electrodes
P.O. # HQ 45

ENG. DWG. #
FLD. DWG. #
SPEC. # SFA 5.5
HOLD TAG # 004

DATE 10/15/75
PREPARED BY: G Cain

NATURE OF NONCONFORMITY: (✓) Shipping Damage | MATERIAL | WORKMANSHIP

DESCRIPTION: 2 - 50 Lb. containers of 3/32" Dia. E-9018-B3 were received from vendor with dents in their surfaces. The containers were damaged upon arrival at jobsite.

BY G. Cain DATE 10/15/75

PROPOSED CORRECTION ACTION: ATTACHMENTS: | X | YES | | NO

Examine containers to determine if seals have been broken or the surface punctured. If they have, return containers to vendor for credit. If they are not punctured or seals are not broken the material should be accepted and removed from Hold.

BY G. Cain / E. Swinney DATE 10/15/75

DISPOSITIONING OF NONCONFORMITY: (✓) | X | QA/QC | | MRB

The containers were examined and determined not to be punctured and the seals were not broken. The containers were removed from Hold, tagged accepted and placed in bin 47 in the warehouse.

BY G. Cain DATE 10/15/75

MATERIAL REVIEW BOARD APPROVALS

NAME	TITLE

DISTRIBUTION: -ONE COPY TO QA- -ONE COPY TO ACI- -COPIES TO CONST PROJ. MGR.-

SAMPLE

1. Describe a user's unassisted quality-assurance program; point out its advantages and disadvantages:

2. Describe a consultant-assisted quality-assurance program:

3. List essential requirements of subcontracting quality-assurance/quality-control functions to another organization:

4. Enumerate the variety of forms and records typically used in implementing quality-assurance/quality-control requirements:

5. Prepare one of the following:

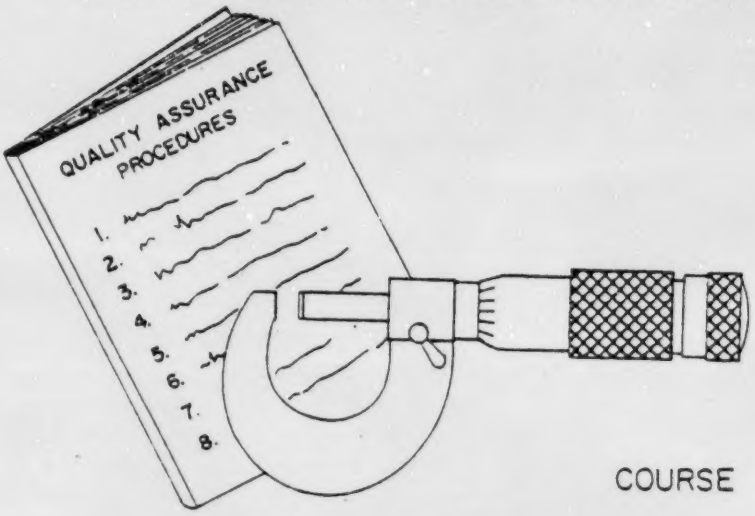
   A QA/QC form to document an activity of nuclear operation of a component or facility.

   Complete each item on a QA/QC form (provided by instructor) with relevant, applicable data, as a sample of an actual case.

NUCLEAR TECHNOLOGY

MODULE 14-8 QUALITY-ASSURANCE/QUALITY-CONTROL
RECORDS AND DOCUMENTS

INTRODUCTION TO
QUALITY ASSURANCE / QUALITY CONTROL



COURSE 14

COURSE MODULES

COURSE 14 - INTRODUCTION TO QUALITY ASSURANCE/QUALITY CONTROL

MODULE 14-1	Basic Requirements for Quality Assurance/ Quality Control
MODULE 14-2	Definitions and Descriptions of Quality-Assurance/Quality-Control Criteria
MODULE 14-3	Governmental Regulation of Quality Assurance/Quality Control (AEC, NRC)
MODULE 14-4	Technical Regulation of Quality Assurance/ Quality Control (ASME, ANSI)
MODULE 14-5	Implementation of Quality-Assurance/Quality-Control Programs and Procedures
MODULE 14-6	Application of Quality Assurance/Quality Control to Industry
MODULE 14-7	Techniques and Variations in Quality Assurance/Quality Control
MODULE 14-8	Quality-Assurance/Quality-Control Records and Documents
MODULE 14-9	Special Studies in Quality Assurance/Quality Control

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INTRODUCTION

Quality-assurance documents and records are required to provide adequate evidence that an item or work activity meets all relevant requirements for quality. Such information is vital to the safe operation and maintenance of a nuclear facility; it is only through such records that assurances, improvements, modifications or changes may be introduced and implemented.

The importance of document and record control systems extends far beyond compliance with a quality-assurance manual; they retain a technical as well as a historical record of the facility.

MODULE PREREQUISITES

The student should have completed the previous modules in this Course.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Define quality-assurance/quality-control records.

2. Define quality-assurance/quality-control documents.
3. Prepare samples of quality-assurance/quality-control records and documents; explain differences between them.
4. Identify records and documents requiring mandatory retention, including length of retention and party responsible for retention.
5. State methods most commonly used in duplication of records and documents.
6. Describe essential elements of a document center's facilities, and personnel qualifications.

Quality-Assurance Criteria XVII ("Quality Assurance Records" of Appendix B to 10CFR50), the ANSI N45.2 Standards and the ASME Code make frequent references to documents and records, and to authorized inspection, authorized personnel and owner's representatives. Therefore, documents and records for a nuclear facility receive considerable attention from the initial stages of planning and design of the facility. The owner must include in the application for permit to design and construct a facility the procedures and methods that the owner intends to implement to safeguard documents and records generated during the licensing, designing, constructing and operating of a nuclear facility.

Advances made in the nuclear industry during the past ten to fifteen years include innovative techniques in the management and control of quality-assurance records. These techniques vary from manual processing of hard-copy documents and records to electronic data processing of documents and records. Industry demands for adequate document and record control systems made it possible for numerous specialized businesses to be established. These businesses may offer the services of a few document-processing clerks, or they may include a total capability including multimillion-dollar computers, totally devoted to document and record control systems.

Regardless of the type of system employed, responsibility for operation and maintenance of the system must be established. Just as in other phases of facility operation, the facility owner is ultimately responsible for the entire facility.

The manufacturer producing a nuclear reactor vessel,

however, is responsible (under the Code) to generate, verify, collect and maintain all necessary records for such a component, and retain such records throughout the life of the component. The owner is responsible only to the extent that such records are verified and stored by the manufacturer consistent with the Code and with the quality-assurance program of the facility.

QA/QC DOCUMENTS AND RECORDS

A quality-assurance document is the original or duplicate copy of a form, certificate, report, photograph, sketch or any other instrument containing data or information relevant to an item, component or activity within a nuclear facility (Figure 14-8-1).

A quality-assurance record is this quality-assurance document after it has been approved, signed or accepted by an authorized individual in evidence of compliance with requirements of the quality-assurance program (Figure 14-8-2).

Other definitions of documents and records may be found in the industry or within different segments of the industry. The intent, however, remains that documents and records are the only documentary evidence of quality of items or of activities affecting quality.

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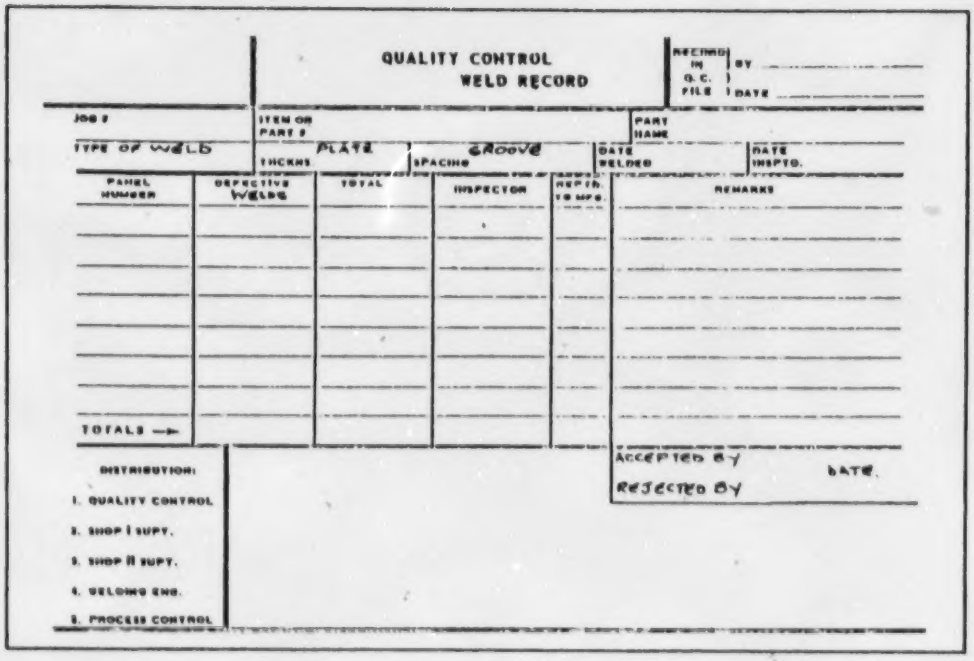


QUALITY CONTROL
WELD RECORD

RECEIVED IN Q.C. FILE — BY _____ DATE _____

JOB # | ITEM OR PART # | PART NAME

TYPE OF WELD | THICKNS PLATE | SPACING GROOVE | DATE WELDED | DATE INSPTD.

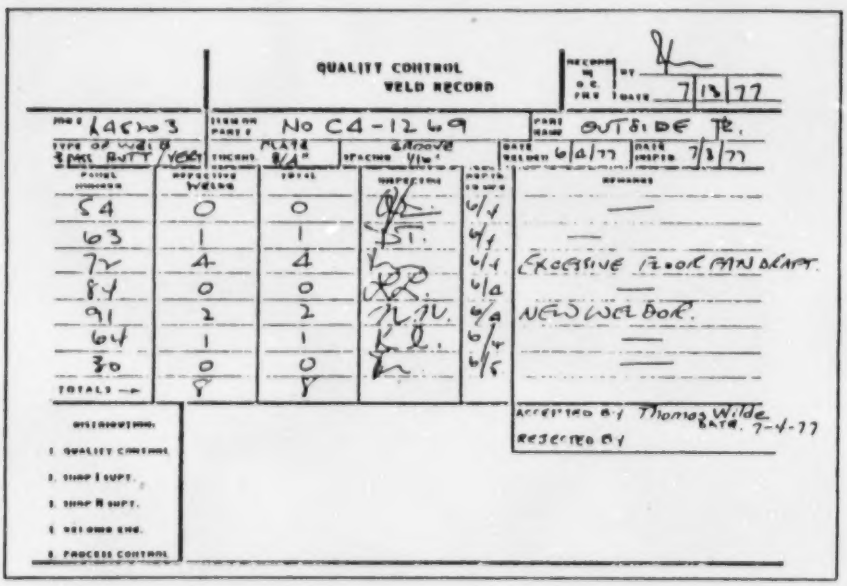
PANEL NUMBER	DEFECTIVE WELDS	TOTAL	INSPECTOR	REPTD. TO WPS.	REMARKS
TOTALS →					

ACCEPTED BY _____ DATE _____

REJECTED BY _____

DISTRIBUTION:
1. QUALITY CONTROL
2. SHOP I SUPT.
3. SHOP II SUPT.
4. WELDING ENG.
5. PROCESS CONTROL

Figure 14-8-1. Quality-assurance document.



QUALITY CONTROL
WELD RECORD

RECEIVED IN Q.C. FILE — BY _____ DATE 7/13/77

JOB # 1450-3 | ITEM OR PART # No C4-1269 | PART NAME OUTSIDE TR.

TYPE OF WELD 3 SMS BUTT / VERT | THICKNS PLATE 3/4" | SPACING GROOVE V-1 | DATE WELDED 6/8/77 | DATE INSPTD. 7/13/77

PANEL NUMBER	DEFECTIVE WELDS	TOTAL	INSPECTOR	REPTD. TO WPS.	REMARKS
C4	0	0	[illegible]	6/4	—
63	1	1	[illegible]	6/4	—
72	4	4	[illegible]	6/4	EXCESSIVE FLOOR PAN BLAST.
84	0	0	[illegible]	6/8	—
91	2	2	[illegible]	6/8	NEED WELDER.
64	1	1	[illegible]	6/4	—
30	0	0	[illegible]	6/5	—
TOTALS →	8	8			

ACCEPTED BY Thomas Wilde DATE 7-4-77

REJECTED BY _____

DISTRIBUTION:
1. QUALITY CONTROL
2. SHOP I SUPT.
3. SHOP II SUPT.
4. WELDING ENG.
5. PROCESS CONTROL

Figure 14-8-2. Quality-assurance record (completed document).

QA/QC DOCUMENT AND RECORD RETENTION

Documents and records are classified in a manner consistent with the importance of the information and data they contain. When documents and records contain information significant to the safe operation of a plant, they require lifetime or permanent retention. When not classified as significant to plant safety, documents or records require only temporary retention.

Permanent quality-assurance records are required to be maintained by or for the facility's owner for the life of a particular item (while installed in the facility or stored for future use).

Nonpermanent quality-assurance records (those evidencing that quality was achieved in accordance with applicable procedures) need to be maintained only for a specified period of time (less than the life of the item they describe).

In addition, owners or other organizations may designate certain records to be included in one category or the other. For example:

Design and engineering records.

Procurement and purchasing records.

Manufacturing and production records.

Preoperational and startup test records.

Operating and maintenance records.

The following documents contain specific detailed information for the kind of records required and the necessary retention period for each record.

NRC Regulatory Guide - 1.88, "Collection, Storage and Maintenance of Nuclear Power Plant Quality Assurance Records."

ANSI - N45.2 Standard, "Requirements for Collection, Storage and Maintenance of Quality Assurance

Records for Nuclear Power Plants."

The student also should become acquainted with the requirements of ASME Section III, Division 1 and 2.

DOCUMENTS AND RECORDS ADMINISTRATION

Administration of documents and records includes the entire process of handling quality-assurance documents and records, from the time a document becomes a record until it is disposed of at the pre-established time and in the prescribed manner.

Although records administration has become a highly technical field (computers, microfilms, duplicators), the intent is to provide:

Adequate provision for collecting records.

Adequate provision for indexing and identifying records.

Adequate provision for storing and preserving records.

Efficient method of retrieving and distributing records.

All actions connected with the administration of records must be delineated in quality-assurance procedures, including designations of personnel responsible for implementing the procedures. Also, kinds, numbers, and formats of records to be generated must be specified in quality-assurance procedures (other than those addressing the administration phase of records).

DOCUMENT AND RECORD CONTROL CENTER

A document and record control center is the facility in which records and documents are stored. A document center established at a site during construction, where only duplicate records are stored, does not have to be constructed to the same standards as one where original records are stored. If loss or damage occurs at a site facility, copies may be obtained from originals kept elsewhere. Thus, document and record control centers are distinguished as permanent or temporary. Permanent facilities should incorporate the following features:

Reinforced concrete or concrete-block construction.
Structure, doors and other hardward all Class-A fire-rated, with recommended four-hour rating.
Floors, ceiling and walls protected from moisture or condensation.
Forced-air circulation with filter and humidity control systems.
Adequate fire protection system.
Adequate lighting system.
Controlled access to and from the records storage areas.

Record control centers, personnel responsible for their operations, procedures established for such operations must be audited by management. Results of these audits must be recorded and issued to appropriate individuals. Such audits verify the following:

Records logged in receiving documents are accounted for and are in correct locations.
Facility and its structures are in good condition and fire, air and humidity control systems are

in operating condition.

Records maintained in storage are in good condition and are not deteriorating due to improper care or handling.

EXERCISES

1. This module defines "quality-assurance document" and "quality-assurance record;" use these definitions to prepare samples of quality-assurance/quality-control documents and records for the following items:

   A length of high-pressure pipe.

   A radiograph of a pipe weld.

   A magnetic particle inspection of a small, forged part.

   An ultrasonic test of a pipe flange.

   Fill out needed information; designate which is a document and which is a record.

2. Sketch a record control center; list what you consider the most essential elements of your center. Why?

3. Compare quality-assurance record-keeping requirements of the following:

   10CFR50, Appendix B.

   ANSI N45.2 - 1971.

   ASME Boiler and Pressure Vessel Code.

   Regulatory Guide 1.88.

   What does each govern? In case of a conflict, what is priority order?

MATERIALS

None.

PROCEDURES

None.

DATA TABLE

None.

REFERENCE MATERIALS

American National Standards Institute (ANSI). "Requirements for Collection, Storage and Maintenance of Quality Assurance Records." American National Standard, Reactor Plants and Their Maintenance ANSI Standard N45.2.9 New York: ANSI.

National Fire Protection Agency. "Standards for the Protection of Records," no. 232, Vol. 9. Boston: National Fire Protection Association, 1970.

U.S. Nuclear Regulatory Commission. "Collection, Storage and Maintenance of Nuclear Power Plant Quality Assurance Records." Regulatory Guide, no. 1.88. Washington DC: U.S. Government Printing Office.

Read each question carefully. Be sure to provide the specific information each question requires. Make your answer brief. Use the backs of the test if you need more space.

1. What are quality assurance/quality control documents?

2. What are quality assurance/quality control records?

3. What is the difference between permanent records and nonpermanent records, with regard to retention?

4. What is the purpose of records administration?

5. In a nuclear facility, what are three major purposes of audits by management?

a. _____

_____

b. _____

_____

c. _____

_____

6. Give the title and number of the two documents that contain detailed information about the kinds of records required and the necessary retention period for each record in a nuclear facility.

7. Name the essential construction features of a permanent document storage facility.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

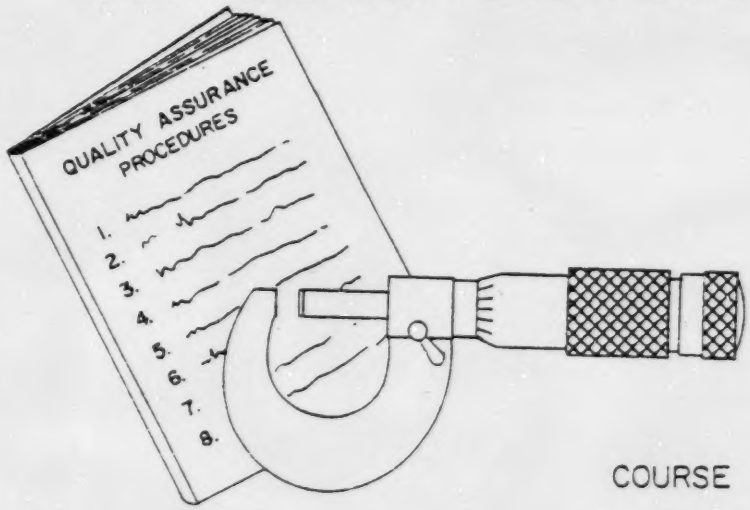
_____

_____

NUCLEAR TECHNOLOGY

MODULE 14-9 SPECIAL STUDIES-IN QUALITY ASSURANCE/ QUALITY CONTROL

INTRODUCTION TO QUALITY ASSURANCE / QUALITY CONTROL



COURSE 14

COURSE MODULES

COURSE 14 INTRODUCTION TO QUALITY ASSURANCE/QUALITY CONTROL

MODULE 14-1 Basic Requirements for Quality Assurance/ Quality Control

MODULE 14-2 Definitions and Descriptions of Quality-Assurance/Quality-Control Criteria

MODULE 14-3 Governmental Regulation of Quality Assurance/Quality Control (AEC, NRC)

MODULE 14-4 Technical Regulation of Quality Assurance/ Quality Control (ASME, ANSI)

MODULE 14-5 Implementation of Quality-Assurance/Quality-Control Programs and Procedures

MODULE 14-6 Application of Quality Assurance/Quality Control to Industry

MODULE 14-7 Techniques and Variations in Quality Assurance/ Quality Control

MODULE 14-8 Quality-Assurance/Quality-Control Records and Documents

MODULE 14-9 Special Studies in Quality Assurance/Quality Control

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INTRODUCTION

Selection of methods for performing inspections, tests and examinations to verify the existence of quality is of major importance to a nuclear facility. An engineering staff must designate appropriate types of tests to be performed, and the physical or chemical properties to be evaluated. A combination of tests and criteria are usually required to determine, evaluate and verify the presence of quality.

This module describes the most common approaches used in the nuclear industry in general and nuclear power plant facilities in particular.

MODULE PREREQUISITES

Student should have completed all previous modules in this Course.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Describe how standards of quality are established in

technical specifications.

2. State essential qualification of QA/QC personnel.
3. Describe levels of certification of quality-assurance and quality-control personnel.
4. List kinds of inspections and tests used most commonly to determine quality.
5. List several benefits of on-the-job training of QA/QC personnel.
6. Prepare a nonconformity report.
7. Perform an inprocess inspection of an activity and complete an inspection report.

QA/QC SPECIFICATIONS

Technical specifications list those mechanical and physical properties necessary to ensure that an item will perform in accordance with design parameters. Quality-assurance specifications complement technical specifications by stating the necessary requirements for ensuring that an item performs satisfactorily during operations.

For example, technical specifications for a pump may include:

- Type of fluid to be pumped. (If fluid is corrosive, pump and associated piping must be corrosive resistant - stainless steel or nickel.)
- Amount of fluid to be pumped. (Determines pump capacity.)
- Pressure and head losses of fluid to be pumped.
- Environment in which pump must operate (e.g., temperature, weather conditions, dust).

The quality-assurance specifications for this same pump may include the following:

- Verification that material requirements are adequate (e.g., to show that materials are corrosion resistant).
- Verification that pump will deliver required flow at specified head.
- Verification that environmental protection is met - pump operation does not endanger personnel or property.

QA specifications include conditions and procedures for tests to provide the necessary verifications. Quality assurance is a double-check (verification) that technical specifications are actually met.

QA/QC PERSONNEL QUALIFICATIONS

Qualifications for QA/QC personnel are based on knowledge, experience and training (as specified by codes, standards and regulatory guides). For example, in selecting an individual as a welding quality-control inspector, the following qualifications must be considered:

Education: Regulatory Guides, ANSI N45.2, AWS, and other standards specify minimum educational requirements.

Technical background (in welding, metallurgy or physics) that meet requirements of referenced standards.

Demonstrated competence in welding technology (certifications provided by American Welding Society or National Board of Boiler and Pressure Vessel Inspectors).

Knowledge of operation of welding equipment and tools.

Ability to weld.

Knowledge of commercial aspects of welding (e.g., trade names of welding electrodes, filler metals and gases).

Understanding of applications and limitations of welding and welding processes.

Experience in following instructions and inspection procedure outlines.

Management may consider certain personal qualifications

as important as those listed above; for example:

Ability to follow directions.

Ability to communicate in technical and nontechnical languages with various groups.

Ability to cope with job pressures and work crisis.

Ability to get along with fellow employees.

CERTIFICATION, QA/QC PERSONNEL

Certification of QA/QC personnel, required in all phases of nuclear power plant construction, maintenance and operation, is a formal guarantee that they are qualified to inspect in their field of expertise. The quality-assurance program, Regulatory Guides, ANSI Standards, ASME Code, as well as the Society for Nondestructive Testing (SNT) and other codes, specify the necessary level of certifications required for each position on a QA/QC staff.

Quality-control personnel qualifications and certification requirements are best described in the following documents:

ANSI N45.2.6 Standard, "Qualifications of Inspection, Examination, and Testing Personnel for the Construction Phase of Nuclear Power Plants."

NRC, Regulatory Guide 1.58, "Qualification of Nuclear Power Plant Inspection, Examination, and Testing Personnel."

In addition, the Society for Nondestructive Testing publishes a prominent standard (SNT-TC-1A) for testing and

certification of nondestructive examination personnel for competency in specific technologies, including:

Radiography.
Ultrasonics.
Liquid penetrants.
Magnetic particles.
Eddy currents.

The nuclear industry, over the years, has come to recognize three levels of certification of personnel in the field of inspection, examination and testing:

Level 1 - Calibrates and uses inspection and examination test tools and equipment; does actual hands-on work, under supervision and surveillance of Level 1 or Level 2 certified personnel.

Level 2 - Supervises Level 1 personnel; verifies calibration of inspection and test equipment; plans tests and determines validity of inspection and test results.

Level 3 - Supervises Level 2 personnel; prepares inspection and test procedures; analyzes, evaluates and certifies test results.

INSPECTIONS, TESTS AND VERIFICATIONS

Inspections, tests and verification methods may be catagorized:

Visual.
Physical.
Chemical.

Sampling.
Performance.
Comparative.

VISUAL METHODS

Visual inspections are limited to in-progress verifications. Visual inspection of a completed item can not provide adequate data on internal parts; therefore, visual inspection must be carefully planned and scheduled to allow timely access for investigation.

Visual inspection may be performed with or without the aid of test instruments, equipment and tools. A person performing this type of inspection must be trained to recognize properties, dimensions and specific configurations of items.

Example:

In making a weldment in a pipe joint, inspector must verify that the joint has a backing ring. This verification can be made simply by looking at the joint to be sure the ring exists (unaided inspection).

PHYSICAL METHODS

Physical inspections complement other methods (they are not necessarily adequate when performed alone). These types

of inspections may utilize destructive tests or nondestructive tests.

Example:

1. A drawing may specify that certain tolerances must be obtained for a pump to operate properly. By using micrometers, go/no-go gages or other measuring devices, tolerance may be checked. This method utilizes physical inspection of a known condition.
2. Specifications for a splice of a reinforcing steel bar may require that the joint be as strong or stronger than the bar itself. To verify this strength, the bar may be subjected to a destructive physical test. When the test results are evaluated, the integrity of the joint will be established if the bar broke outside the joint, or if the joint broke with a greater strength than the specified value for the bar.

CHEMICAL METHODS

Chemical inspections often supplement other test methods to increase confidence level in product quality. Just as with a physical test, a chemical test may not always be

adequate when performed alone. Usually, a chemical inspection is used in conjunction with a physical test, and the results are correlated to establish that product quality is as specified.

Example:

A high-temperature steam pipe is to meet the requirements of SA-335, Grade P-22, which specifies a structural strength and an alloy content of no less than 2.25 percent chromium. A sample of the pipe is chemically analyzed to ensure that its chromium content is within the specified limits. And the pipe is physically tested to ensure its structural strength.

SAMPLING METHOD

This method is used when a large number of items are produced, but every item can not be inspected because of the large cost involved (or other practical considerations). Rather, a sampling technique is used; that is, only one item in ten (for example) is tested. This method risks two errors: 1) it may "reject" and "acceptalbe" quality, and 2) it may "accept" a "rejectable" quality; therefore, when a sampling method is used, upper and lower limits of acceptance must be established.

PERFORMANCE METHOD

Performance inspection and test methods are used when an item is produced under changing conditions. In testing the performance of such items, a level of confidence in the quality of such an item is established.

> Example:
>
> To test the ability of a filter to reject the passage of particles larger than 0.0001 inch, the filter may be subjected to an actual performance test to ensure that no particles of the size to be rejected are passed.

COMPARATIVE METHOD

Comparative inspections are performed on scaled-down models. Test results are evaluated and extrapolated from the test model to the actual product.

ON-THE-JOB TRAINING, QA/QC PERSONNEL

Although QA/QC personnel are selected on the basis of education and experience, on-the-job training (OJT) is con-

sidered an effective means for better implementation of quality-assurance procedures. OJT offers management and the trainee an opportunity for better communications, better understanding and higher efficiency. Such training, however, must be provided in accordance with a pre-established plan.

Training usually begins with an introduction to the organization, to its quality-assurance program and its objectives. In these introductions, the individual has an opportunity to hear and become familiar with management personnel and the way they view their organization and their program.

Afterward, the individual usually is assigned to work side by side with a co-worker or supervisor. During this phase, the individual observes the program in action - how it is implemented and how it functions. Later, the individual, with limited instructions, performs assigned duties. Although the individual performs independently, close watch is maintained by management.

In addition to direct benefits from on-the-job training, non-QA/QC personnel receive an understanding of the needs for tests and documentation, as well as familiarity with QA/QC personnel duties and responsibilities. (It is a documented fact that OJT enhances overall effectiveness of a quality-assurance program.

SEMINARS, ORIENTATIONS & PERSONNEL INDOCTRINATION

Seminars, normally to share experiences, allow participants to make their own decisions as to how their know-

ledge and procedures compare with those of others similarly involved.

Orientations, similar to seminars in their basic objectives, involve more elementary details intended to help those not intimately familiar with the topics of discussions.

Indoctrination programs are usually intended for beginners and new hires. The programs introduce participants to the topic of discussion together with the reason as to why certain procedures are required and how such requirements may be met.

Because quality-assurance is relatively new to the nuclear industry, most organizations develop their own indoctrination and orientation programs, customized to the level of their QA/QC personnel. The industry at large and the Nuclear Regulatory Commission also present seminars on various related subjects. Other seminars are often put on by consultants, educators and private groups.

EXERCISES

1. Explain the difference between certification and qualification. Give an example of the use of each term.
2. List the six types of inspection methods discussed in this module.
3. On-the-job training was described as one of the effective means leading to the implementation of the quality-assurance program; list benefits of such training.

MATERIALS

None.

PROCEDURES

None.

DATA TABLE

None.

REFERENCE MATERIALS

American Society of Mechanical Engineers (AMSE). "Qualifications of Inspection, Examination and Testing Personnel for the Construction Phase of Nuclear Power Plants," ANSI N45.2.6. American National Standard, Reactor Plants and Their Maintenance. New York: ASME.

U.S. Nuclear Regulatory Commission. "Qualification of Nuclear Power Plant Inspection, Examination and Testing Personnel." Regulatory Guide, no. 158.

Available by writing the Superintendent of Documents, U.S. Government Printing Office, Washington DC 20402.

TEST

Read each question carefully. Be sure to provide the specific information each question requires. Make your answers brief. Use the backs of the test if you need more space.

1. What are the purposes of quality assurance specifications? How are quality assurance specifications different from technical specifications?

2. What is the purpose of certification for QA/QC personnel in the nuclear industry?

3. Describe the main responsibilities in each of the three levels of certification of nuclear industry personnel in the field of inspection, examination and testing.

3. _____

_____

_____

_____

4. Describe six categories (kinds) of inspections and tests used to verify or determine the quality of items at nuclear facilities. Give one example of when (under which circumstances) each kind of inspection or test might be used.

5. List three benefits or advantages to on-the-job training activities for quality assurance/quality control personnel.

a. _____

_____

b. _____

_____

c. _____

_____